REFERENCE COPY

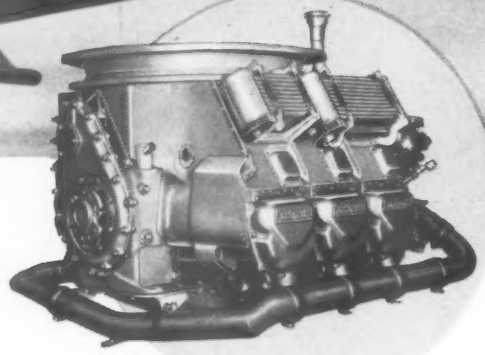
RECEIVED
13 MAY 1958
LIBRARY

May, 1958
35 cents

# ARMED FORCES management

PUBLISHED FOR THE ARMY, NAVY, AIR FORCE, COAST GUARD AND MARINE CORPS

# 30,355 Feet UP!

## ...CESSNA YH-41 HELICOPTER Sets New World Record, with Continental Power

When Capt. James E. Bowman of the U. S. Army Aviation Board flew the Cessna YH-41 to a new helicopter world altitude record of 30,355 feet, he added another to the long list of major performance records already held by Continental aircraft power. Capt. Bowman's mark, exceeding by some 3,400 feet the previous helicopter record, underscores again the wisdom of engineering the power to its job. The YH-41's Continental FSO526 engine is designed expressly for helicopter use . . . fan-cooled for efficient cooling in submerged installation . . . supercharged for maximum power. Its horizontal configuration permits the engine to be located forward, bringing the load directly below the rotors—an ideal situation in helicopter aerodynamics. Finally, the interchangeability of many parts with those of other models in the Continental aircraft engine line tends to simplify service, and reduce its cost.

**Continental Motors Corporation**

AIRCRAFT ENGINE DIVISION

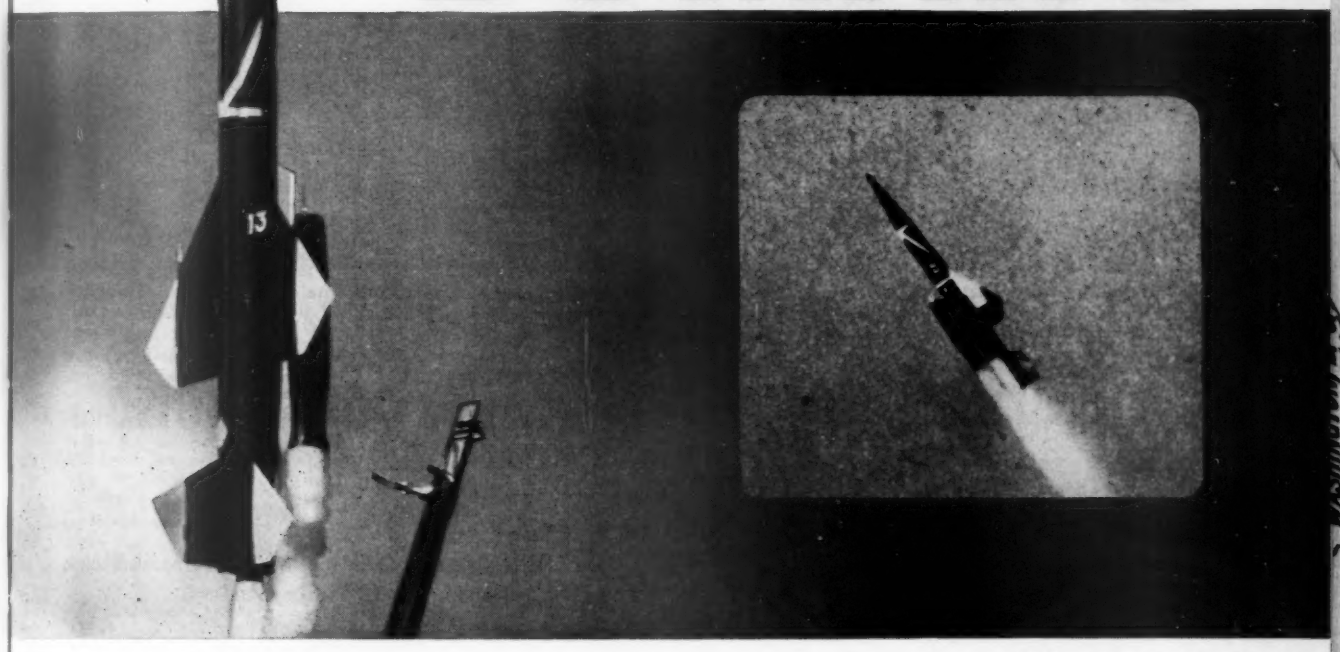
MUSKEGON • MICHIGAN

CONTINENTAL IS ON THE MOVE IN 1958

For more facts request No. 1 on reply card.

*Preserver of Peace...*

# BOMARC



*Official U.S. Air Force Photo*

## *It tracks down an enemy at 300 miles*

Described as the most potent of all ground-to-air defense missiles, the Bomarc pilotless interceptor, designed by Boeing, stands poised for the destruction of any "enemy" bomber within a 200-300 mile range. Its booster rocket has the power to hurl it more than 60,000 feet straight up; then, powered by two ramjet engines, it hurtles by electronic instinct to its target at up to 3 times the speed of sound. For this guardian of our homes and way of life, RCA has been privileged to supply important advance components of the guidance system.

RCA Tmk(s)®

**RADIO CORPORATION of AMERICA**

DEFENSE ELECTRONIC PRODUCTS

CAMDEN, NEW JERSEY

Caterpillar DW20 Tractor with No. 456 LOWBOWL Scraper is pushloaded by a D9 Tractor equipped with a pushcup. With eight other DW20s it is working on construction of runways, taxiways and other facilities at Bergstrom Air Force Base, near Austin, Texas. Altogether, the fast-moving DW20s are getting up to 20,500 cu. yd. in a 20-hour working day on hauls of 1 to 2½ miles round trip.

# Job report on Bergstrom A.F.B. construction

Near Austin, Texas, the H. B. Zachry Company is building runways, taxiways and other facilities for the new Bergstrom Air Force Base. This is a big operation—2,370,000 cu. yd. of excavation. In addition, it calls for 300,000 yd. of select base material and 503,000 yd. of concrete pavement. Runways are 12,250 ft. long, 300 ft. wide.

Work started in April, 1957, and is being handled by nine Caterpillar DW20 Tractors with No. 456 LOWBOWL Scrapers, two Cat D9 Tractors, six D8s, two D7s and seven No. 12 Motor Graders.

The DW20s are getting up to 20,500 cu. yd. in a 20-hour working day. Rough material, too—clay, limestone conglomerate, shale and black gumbo. Round-trip hauls have varied from 1 to 2½ miles.

Powered by a Cat Diesel Engine, the four-wheel DW20-No. 456 rig has the power and stability for big-volume hauling at high speeds. It's rated at 18 cu. yd. struck, 25 heaped. Ten-speed transmission offers a selection of speeds to handle any job. Easy to see why the Caterpillar DW20-No. 456 wheel unit has a proved economy record!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

Caterpillar D8 Tractor pulling a disk harrow and a D8 pulling a sheepsfoot roller are among the many pieces of Caterpillar-built equipment working on runway construction. The D8s feature dependable Cat Engines, operator-convenient, power-boosted controls and built-in quality for long life.

**CATERPILLAR**

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

WANTED—
THE HARD WORK

Managing Editor
**C. W. Borklund**
Financial Editor
**W. Mac Stewart**
Editorial Assistant
**Mary-Jo F. Aarestad**
Art Director
**William H. Martin**
Asst. Art Director
**Bacil Guiley**
Production
**John Walen**
Marketing Director
**Arthur J. Newfield**
Librarian
**Arax Odabashian**

**Editorial and Advertising Offices: 1001 Vermont Ave., N.W., Washington 5, D. C. Phone: STerling 3-5400.**

**Business Office: Lawrence L. Brettner, Circulation Director; Geneva C. Kinnaird, Circulation Fulfillment Manager.**

**M. Michael Cerick**
**Advertising Sales Manager**

★

Regional Advertising Offices

New York 17, New York
**M. Michael Cerick**
**Advertising Sales Manager**
**17 East 48th Street**
**Plaza 3-1100**

Beverly Hills, Calif.
**Irvin G. Rios**
**Regional Advertising Manager**
**BRadshaw 2-6561.**

Chicago 2, Ill.
**John H. Anderson**
**Regional Advertising Manager**
**139 N. Clark St.**
**CEntral 6-5804**

Toronto 1, Ontario, Canada
**Allin Associates**
**12 Richmond St. East**
**EMpire 4-2001**

Montreal, Quebec, Canada
**Allin Associates**
**1487 Mountain St., Suite 4**
**Victor 5-6898**

★

**Main corporate offices at 1001 Vermont Avenue, N.W., Washington 5, D. C.**

**Wayne W. Parrish**
**Publisher**
**Leonard Eiserer**
**General Manager**

★

Other American Aviation Publications

**American Aviation Magazine, Missiles and Rockets, Aviation Daily, Air Cargo, Official Airline Guide, World Aviation Directory, Airports, Air Traffic News, Who's Who in World Aviation, Aviation Facts and Figures, Aircraft Year Book, Missile Week.**

**Unsolicited manuscripts should be accompanied by a stamped, self-addressed return envelope. Armed Forces Management does not assume responsibility for the return of any unsolicited material.**

# ARMED FORCES management

PUBLISHED FOR THE ARMY, NAVY, AIR FORCE, COAST GUARD AND MARINE CORPS

**MAY, 1958**

**Cape Canaveral—Doorstep to Space** ..... 6
Sometimes called the Free World's largest outdoor testing laboratory, the Air Force Missile Test Center has an operation almost as complex as the missiles it tests.

**How the Army Tests at Aberdeen** ..... 16
Col. John D. Armitage tells how Aberdeen comes up with its only product—an Ordnance product test report.

**Why the Air Proving Ground Center Is Changing Its Operation** ... 18
Maj. Gen. Robert W. Burns describes how changing war technology has presented new operating problems at Eglin Air Force Base.

**Management by Exclusion** ..... 24
Maj. Gen. William M. Creasy, Army Chief Chemical Officer, points out the criteria by which the Chemical Corps decides when to step outside the organization to handle a special task.

**Systems: Panoramic Approach to Management** ..... 30
W. Sidney Taylor details how systems engineering concept can improve management and why the idea should be expanded.

**Stretching the Dollar at Joliet Arsenal** ..... 33
Col. Samuel W. Parnelle, Jr., shows how an electronic computer improved the Joliet operation.

**Where Procurement Fits in Today's Supply System** ..... 34
Lt. Col. M. J. Haas lists the reasons supply managers must estimate the impact of their decisions in broad terms.

**How Navy Ordnance Controls Material Quality** ..... 35
Courtlandt C. Van Vechten outlines the ground rules for Navy Ordnance quality control.

**Six Concepts for Comptrollers** ..... 36
What they are and what they mean by Captain V. E. Day, USCG.

**A New Way to Analyze Funds Audit Reports** ..... 39
Victor Gailey describes the new system at Oklahoma Air Materiel Area.

**What Is Wrong with Our Missile Program** ..... 41
Dr. Howard A. Wilcox, in strong language, advances some new ideas on a much discussed question.

**Problems in Technical Publication Management** ..... 45
Third in a series by Roswell Ward.

## Departments

In My Opinion ..... 4
Editorial ..... 5
Washington Background ..... 12
Research and Development ..... 14
Personnel Preview ..... 21
Pentagon Profile ..... 22
Professional Services ..... 23
Procurement and Logistics ..... 28
Dates To Circle ..... 46
Your Investment Future ..... 47
Rundown of Key Contracts ..... 48
Advertisers' Index ..... 48
New Products ..... 49

★ ★ ★ ★ ★ ★

**ARMED FORCES MANAGEMENT** **Volume 4—No. 8**

**Published monthly by Professional Services Publishing Company, a subsidiary of American Aviation Publications, Inc., Washington, D.C. Printed at The Telegraph Press, Harrisburg, Pa. Accepted as controlled circulation publication at Harrisburg, Pa. and Washington, D.C.** **Copyright 1958 by the Professional Services Publishing Company.** **Title registered U.S. Pat. Off. Four weeks' notice before next publication date required for change of address. Subscription Rate: One Year—$2.00; Two Years—$3.00; Overseas, One Year—$3.00; Two Years—$5.00.**

# In My Opinion

## One Better

Reference the March issue cover, some of your local subscribers feel that we go the U.S. Army one better in the field of external lifts . . . to be exact, we lift the standard jeep in pairs.

*D. T. Forbes, Jr.,*
1st Lt., USMC
Marine Corps Air Facility
Jacksonville, N. C.

**Which they do—see cut—Ed.**

## Manager Not Needed

Your February editorial concerning a single manager setup for the military monthly payroll points up a situation that can be improved without a single manager.

The Army (part of it, at least) has for as long as I have been in it (nearly 18 years) followed the practice of issuing one check to banks with schedules requesting that the accounts of the individuals named thereon be credited with the amounts shown opposite their names. This practice has been limited primarily to officers, but recently has been extended to enlisted personnel of the top three grades and, under certain conditions, to the lower grades.

As a starter, each service should authorize all military members and civilian employees without restriction to designate a bank to receive their salary checks. Then, on each pay day, finance officers could combine the salaries of all personnel designating the same bank and issue lump-sum checks for the total amount to each bank. Each bank would, of course, receive a schedule listing name of and amount to be credited each individual depositor.

The next step would be for the services to tell their officers first, and later all personnel, that effective at some reasonable date in the future (three to six months), individual salary payments, either in cash or by check, would not be made directly to the individual, but would be made to a bank to be designated by the individual. It is understood that some foreign nations now use a similar system for paying their officers. Such a system would of necessity have to have enough flexibility to provide for personnel stationed at foreign posts not serviced by a banking facility. Think of the man-hours that would be saved by eliminating pay lines in addition to the savings that would be realized in the finance offices.

As you say, it may take another ten years to get a single manager for disbursing activities. In the meantime, the individual services can improve their operating efficiency by adopting some of the systems proposed under single manager financial management.

*W. L. Packett*
Major, FC
Central Finance & Accounting Officer
Heidelberg, Germany

## Question

Reference the painting of the Convair ad on back cover your March '58 issue—I give up. Where is it? The terrain suggests a rugged sub-arctic site. The position of Polaris fixes it in the middle latitudes.

*R. E. Foley,*
Lt. Comdr., USCG

## Answer

The commander who wrote you regarding location of the test tower in our advertisement, "Convair—Astronautics: Shedding Light on the Mysteries of Space," knows his Polaris. While he had no model of any kind to work from—only a picture of the tower—the scene represents the artists's notion as to what the Astronautics Division's test tower might look like in a setting located in Sycamore Canyon only a few miles from San Diego. As a touch of validity either he or our agency account executive did check with one of the astronomers at the Griffith Park Planetarium in Los Angeles and was assured that the Big Dipper and Polaris in the relationship depicted would be in the sky at the time the ad was initially scheduled to run, which was in December.

*Emmett McCabe*
Director of Advertising
Convair


**"Now, in the event of all-out war, our primary target will be the Pentagon; secondary target, the Bureau of the Budget."**

EDITORIAL

# Reorganization–Will it Change Anything?

LIKE the month of March, President Dwight David Eisenhower roared into Congress with his Pentagon reorganization plan just after Easter. Now, just a few weeks later, his "fighting campaign" to push the plan through, again like the month of March, is beginning to assume all the characteristics of a lamb.

Under a sharp, pointed interrogation by "Uncle Carl" Vinson (D-Ga.) and his House Armed Services Subcommittee, the "drastic" reorganization plan is shaping up as really not much of a change over the present operation.

In his last hours of testimony to the subcommittee, Defense Secretary Neil McElroy spent most of his time backtracking on the strong, albeit ambiguous, language of the proposal. At a disadvantage because he was facing men who, for the most part, have been through this reorganization bit before, he finally admitted, on most points, that all he was after was a clarification of what is already law—Congress can handle clarification with nothing more complicated than a note to the White House.

On one point he stood firm: he does not believe Defense could operate if Vinson managed to push through his bill drastically slashing the civilian offices. The subcommittee seemed to accept that. On other points, such as unified commands (which McElroy called the "heart and soul of the plan"), the Defense Secretary seemed to conclude that all he was really interested in is finding out what is going on–an understandable attitude for an intelligent man only six months in the Pentagon.

Net result: in the following months there will be a great deal of conversation about the present organization and how it should be changed as these hearings grind on; but it is pretty safe to predict that there will be "business at the same old stand" for some time to come–at least as far as the House is concerned.

What panicked people into believing Eisenhower's plan was really something was his tough talk when he sent the plan to Capitol Hill, plus his warning to military men who might want to criticize it. Now that all the shouting has died down, it becomes more and more apparent that his plan to shake up the Pentagon, as he interprets it, is little more than a jiggle.

Along the way, Eisenhower has managed to violate the first rule of good administration, to whit: specific reorganization along specific lines to correct specifically stated problems. Instead, he devoted most of his text to telling what it would do–mostly generalized claims aimed at popular appeal such as more security, less cost, streamlining, etc.

In spite of this strange beginning, the outcome is likely to be beneficial to the Defense organization. Any business which requires $40 billion a year to operate needs a good debate occasionally to keep it from ossifying.

It should be clear to military men, however, that one part of their jobs is due for a change. Nearly all major facets of Eisenhower's plan concern, in one form or another, ending interservice rivalry; *i.e.* public debate over conflicting military ideas—a greatly overplayed problem anyway.

The main reason the Commander-in-Chief is pushing this so strongly seems to be that it upsets the American public. This is too bad. It would be far better for them and for the Nation's defense if some attempt was made to jar the American public into becoming informed on this subject–far better than letting them be lulled into thinking our military effort is running smoothly because they no longer read about any arguments. For the debates will still go on, buried inside the Pentagon. They can not be avoided.

To quote Army Chief of Staff General Maxwell Taylor, who has been involved in controversy as much as anyone else during the past few months:

"While we can agree pretty well on what kinds of war for which we should prepare and the categories of forces which we should have, we soon run against the very tough question of 'How much is enough?' What makes these questions particularly tough is the uncertainty as to the performance of our new weapons. We have no basis of experience to serve as a point of departure in many of our discussions. Consequently, in the long run, decisions must be reached on limited data, supported only by professional experience and common sense. It should be understandable that under these conditions there will sometimes be no unanimity of opinion among the Service chiefs.

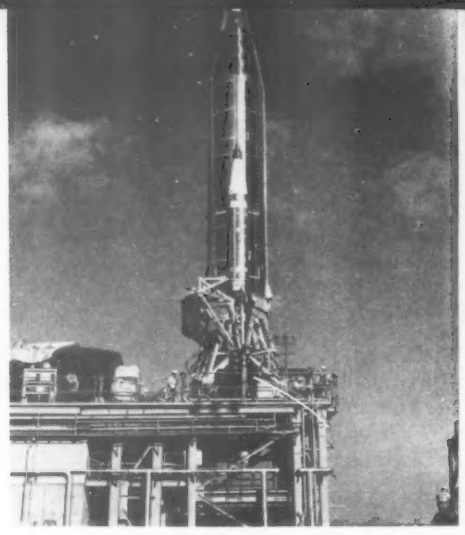
"But I believe that the occasional disagreements, which are far rarer than the many significant areas of agreement, do not necessarily indicate selfish interest or narrow partisanship. There would be grounds for real concern if suddenly there were complete unanimity in the councils of the Pentagon. It would be cause for legitimate anxiety for the integrity and freedom of thought in the Armed Forces."

Interservice rivalry can not be legislated out of existence any more than freedom of thought can be legislated out of men's minds. Unfortunately, Taylor's is a small voice trying to calm an excited public tilting its lance at a windmill whose dimensions it does not perceive.

***Bill Borklund***

# Cape Canaveral . . .

## Doorstep to Space



by Bill Borklund

***Free World hopes for victory on today's cold-war battleground—missiles and space—rise or fall depending on what happens at the Air Force Missile Test Center. Sometimes called the Free World's largest outdoor testing laboratory, AFMTC has an operation almost as complex as the missiles it tests.***

ON JULY 24, 1950, the sun had just begun its climb up over the Atlantic Ocean for a look at Florida's east coast, when a group of missile scientists wheeled up to the high, steel-mesh fence which sealed Cape Canaveral off from the rest of the world.

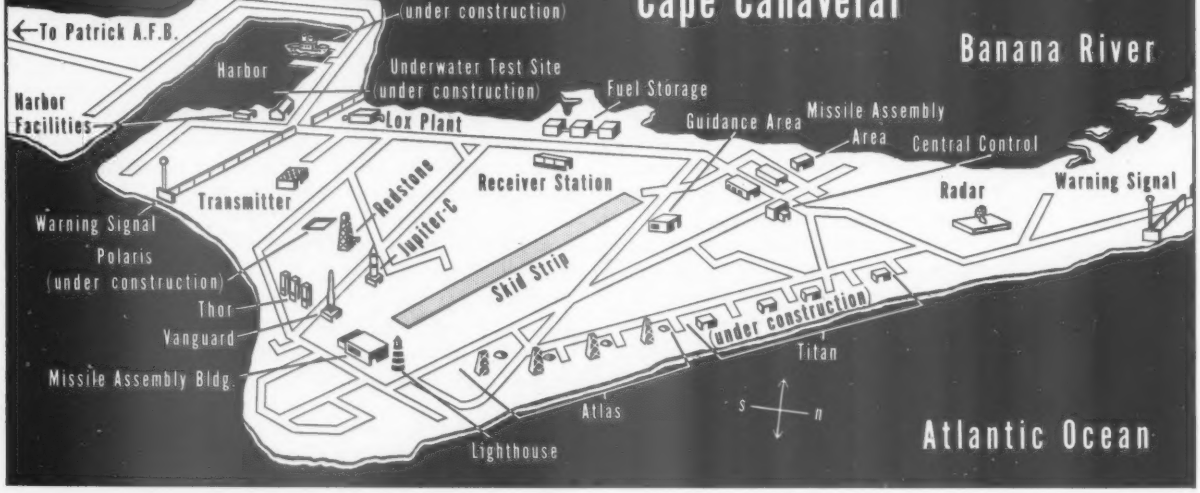
Pausing to chew on cigarettes and talk to the Pan American Airways security officer, they waited while two fellow technicians barreled their cars up and down a road, scaring snakes off the path leading to a concrete slab in the middle of the Cape. Road cleared so they could go to work, the crew went out to their launch site and began final checkout of a German Vengeance-2 rocket setting on the slab. Moments later, at 9:29 in the morning, countdowns completed and buttons pushed, the V-2 roared out over the Atlantic, a WAC Corporal missile in its nose, and the range was in business.

This was the first test at the Air Force Missile Test Center which, eight years later, has burgeoned into a $400-million shooting gallery which now stretches 5000 miles southeast into the Atlantic to Ascension Island. The snakes no longer have to be chased off the roads leading to launch sites* but the Air Force is still not without its problems in running the AFMTC.

Among the never-ending headaches: *construction* (which may never stop, said one Air Force officer, if people don't quit running into the Pentagon with new ideas for moon shots under their arms); *housing* (680 Wherry housing units at Patrick Air Force base plus a 999-unit Capehart project† now under construction seem always

** Cape Canaveral has by no means scared off all the snakes, alligators, rabbits, lizards and armadillos who still hold original squatters' rights to the sand and dense scrub bush. Latest story being circulated around the bars of Cocoa Beach and Bravard County concerns the second-shift technician who walked into a darkened blockhouse on the Thor launch site and nearly put his foot into the wide-open mouth of a hungry alligator.*

*† Even the Air Force is still wondering why this privately financed program quit one short of an even thousand.*



one step behind the growth in AFMTC's work force, up from 800 people in 1949 to over 15,000 today, expected to exceed 18,000 by year-end); *maintenance* (which is probably 25 percent more difficult here than at any other AF base because of the salt-air corrosion); and *logistics* (to keep its 12 major downrange tracking stations alive, the Air Force must ship 5 million pounds of supplies to them each month).

The Air Force Missile Test Center, one of 10 major operations under control of the Air Research and Development Command, is comprised of three distinct operating parts: one, Patrick Air Force Base, the 1800-acre administrative and support headquarters for AFMTC; two, Cape Canaveral, a 15,000-acre promontory 20 miles to the north, which houses not only all the missile launch pads but also the tracking equipment for range station No. 1; and three, the chain of downrange tracking stations.

Pan American Airways, under Air Force contract, operates the range facilities and in turn subcontracts downrange technical instrumentation aspects to Radio Corporation of America. On the mainland, Pan Am's Guided Missiles Range Division is responsible for pad safety, fire protection, security, meteorology, range clearance and other missile launch support activities. PAA also has RCA under subcontract to operate the data-reduction facility. Here 450 RCA technicians use $8-million worth of equipment to reduce test data to usable form, come up with the only tangible "product" of AFMTC, the Flight Test Report, which the missile scientists use to prove theories right or wrong, to make corrections in their "birds."

Dozens of missile contractors share the industrial facilities, launch pads, etc., including Douglas (Thor), Convair (Atlas), General Electric (nose cone), Air Products (liquid-oxygen manufacturers).

Of the test center's three jobs (operating the range, conducting tests, gathering test data), conducting the tests has, of course, received all the press mileage and stirs up the most interest.

Missiles are extremely complex vehicles. The electronics system alone contains approximately 12,000 different components. It is estimated that a missile has 36- to 37,000 items which must function properly if its flight is to be successful. In order to insure satisfactory operation of three out of four missiles—using an arbitrary figure—the failure of any single electronic item must be limited to one in about 100,000 times. To make matters more difficult, missiles operate through a range of speeds, accelerations, vibrations, altitudes and temperatures never before experienced by our engineers.

Missiles, in most instances, are not recovered for subsequent testing. This makes even more exacting the requirement for getting the maximum amount of experience and information from each individual test.

Actually, the test process on guided missiles begins before the missiles arrive in Florida. Long before missiles reach their launch pads, an extensive testing program on their components has been undertaken elsewhere. Little is taken for granted, even on standard items such as electronic tubes, which in other routine applications are considered highly reliable. Repetitive cyclic testing is conducted. Histories are maintained, as are logs of reliability. In the component test-process laboratory, techniques are exploited to the fullest—furnaces for high-temperature tests, chambers for altitude simulation, sled tests to approximate the acceleration conditions which will be imposed in actual flight. All are pointed toward providing the most rugged and reliable components possible.

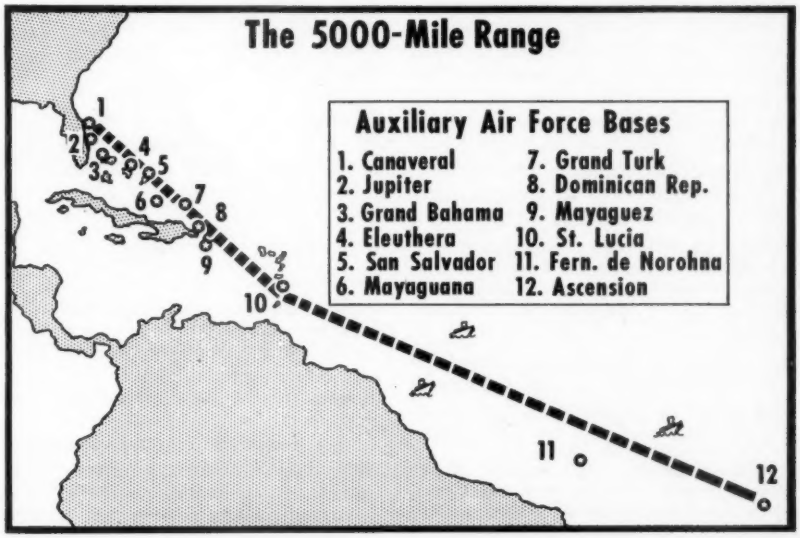
After missiles reach the Test Center, they usually undergo static firings where all operating functions are checked on the ground, including ignition and runup of the propulsion stages.

In live testing, an orderly progression is followed: First, a demonstration of those elements of the system necessary to flight—usually the airframe, autopilot and propulsion component—then, check of the structural integrity of missiles, control response, flame patterns, and the effects of vibrations on such things as plumbing, wiring, etcetera.

After the basic elements have been successfully demonstrated, the complex guidance system, re-entry bodies, simulated warheads and fusing are progressively added until a complete weapon system has been demonstrated.

All missile test firings, whether for the aeroballistic cruise missiles—*e.g.*, Snark, Bomarc—or the ballistic missiles, follow the same pattern. Several days before a scheduled firing*, the missile is flown in (by C-124, except the 80-ft. long Atlas, trucked from California), landed on the skid strip in the center of the Cape (which is also used to recover Snark after firings), and sent to the industrial area, where, in one of the 17 hangers assigned to contractors, the missile is assembled and its components checked.

Interesting sidelight: there has never been a servicewide hassle over who should get to fire what when, for two reasons. One: because a malfunctioning 25-cent valve can negate the test of a multithousand-dollar missile, they test and retest on the ground as long as possible to eliminate all the bad apples they can find in the thousands of parts in any missile. The other reason is an esprit de corps created by missile fever which leaves separate service lines vague and indefinite. Example: in early 1958, when Vanguard




*A *scheduling officer receives from the Air Force Ballistic Missile Division missile test requirements sent in by the three services, makes recommended list. Each Thursday morning he holds a scheduling meeting (anyone with a missile interest can sit in), discusses the list, and comes up with a schedule—which may be outdated as soon as it's published (if a listed test hits a snag, is held during countdown beyond scheduled firing time or, what is worse, scrubbed, i.e. cancelled). For this reason, the scheduling officer sits in on all firings.*

was having all its trouble, AFMTC would have given them any firing time they wanted, including Sunday.

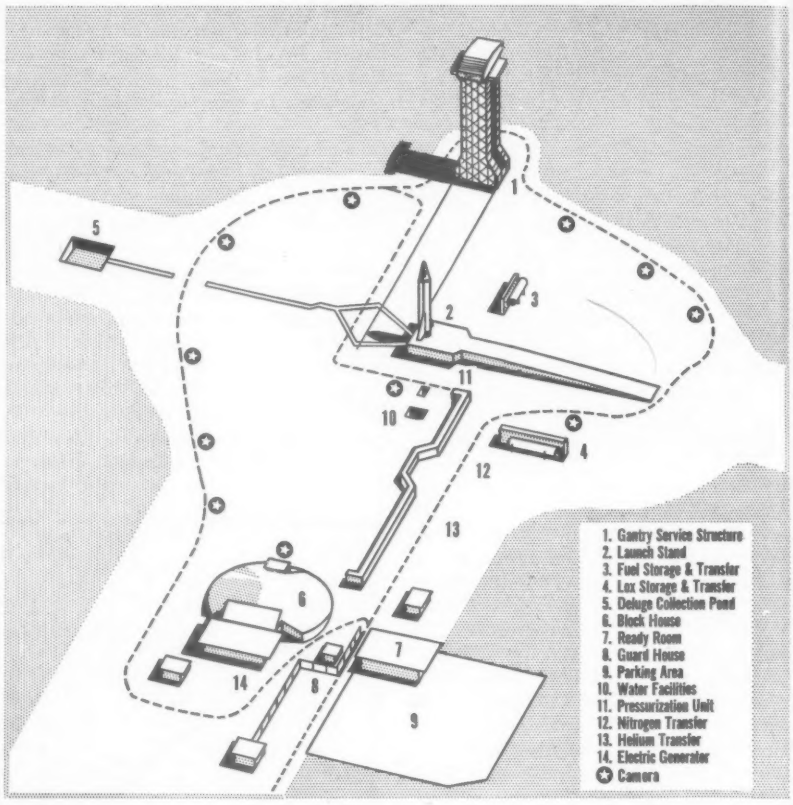
A few hours before launch the missile moves out to its launch stand, a gantry (work tower) is rolled up around it. There, starting some 12 hours before firing, technicians, scientists and missileers swarm over the 12-story-high gantry, running final checkouts and tests of missile parts.

Meantime, in the concrete blockhouses*, experts monitor checks, counter-checks and countdowns, verifying the readiness of their bird.

There is a deceiving air of relaxation as sport-shirted pros hover over consoles watching flashing red lights tick off each monotonous step in the countdown or answer quick phone calls from the test stand or check the stacks of telemetry boxes in the blockhouse, occasionally glancing at the row of closed-circuit TV screens for a visual check of what is happening on the launch pad. At the same time, Central Control, Big Brother to the whole test cycle, determines the readiness of the downrange telemetry stations.

The countdown to firing usually lasts six to eight hours, can go 16 with holds. (In the vernacular of the missile man, "T minus 50 and counting" means a test is in progress, 50 minutes from firing; "T minus 50 and holding" means they've stopped 50 minutes from firing to correct a problem; and "We have recycled, are at T minus 90 and counting" means they got somewhere closer to firing, hit a snag, had to back up the stream someplace and start over).

*The blockhouses vary in their protective size and distance from the launch stand according to the amount of fuel in the area. Atlas blockhouse, for instance, is 750 ft. away, built to withstand a 50,000-lb. blast at 50 ft. (by covering 5 ft. of reinforced steel with a 10-ft.-thick coating of sand, icing the whole thing with gunite, a kind of spray-on cement). Vanguard blockhouse, on the other hand, is only 175 ft. away.*




**Typical components of ballistic missile launch site are shown in this drawing of Atlas pad. Cruise missile sites are simpler, have only paved area for mounting zero-length launcher and duct for wires leading back to blockhouse.**

At T minus 150 minutes, two planes take off from Patrick Air Force Base. One, a radar-equipped B-17, flies downrange, relays back to central control when ships are in the downrange area. If there is something like a 100,000-to-1 chance the ship might be hit, either the ship is ordered out of the area or the shoot is delayed.

The other, a C-131 with a crew of eight, is packed with tiers of electronic equipment to scan radio frequencies, finds ones they can use for the telemetry transmitters in the missile. Several frequencies are needed and they differ each time, depending on the missile's range, etc. Telemetry receivers can pick up no data on how the missile parts behave during the test if the frequencies are garbled (as they were once by a cab driver in Texas and once by U.S. forest rangers in the Northwest fighting a fire—who, when informed they were using an Air Force frequency, roared right back that the Air Force was using their frequency and could darn well get off, which it did).

**Shown here with his hand on the EGADS button, Range Safety Officer has key job in any test.**

At T-Time a black button is pushed which, something like an auto ignition, starts the chain reaction which results in a firing. (With the Jupiter, this time lag from button-pushing to missile launch is something like 16 seconds. With the Atlas, it's even longer because large steel clamps actually hold the missile down while its engines roar full blast, building up enough thrust to lift it off the pad). With the firing, the AFMTC job is just beginning.

For a few seconds after launch, the blockhouse has control of the missile. After that it reverts to Central Control,

where two men, essentially, have the whip hand for the rest of the missile's flight. One, the supervisor of range operations (SRO), is overall director and coordinator for the range during a launching operation and coordinates activity in the operations room of Central Control.

The other is the range safety officer, whose job, specifically, is to see that no missile presents a hazard or violates an unsafe area. It is the one job at AFMTC that the Air Force does not delegate to anyone. The range safety officer is responsible for two areas—ocean and air safety. Of the two, air safety is relatively easy. He merely notifies Miami Air Traffic Control prior to a shoot to divert air traffic inland.

Ocean safety is another matter. Sitting at a console in Central Control, one hand on the EGADS* button, the range safety officer, whose job in ballistic missiles lasts only for the few seconds of powered flight, watches the course of the missile being plotted on a range plotting board in front of him. On the board, the downrange course is laid out in a grid pattern, bounded on either side by a destruct line, which is the boundary of the playing field.

Key to the range safety officer's success is the Azusa impact predictor system (named after the California town where it was invented), developed by Convair and operated by RCA. Azusa's job: predict every 80/1000 of a second exactly where the missile would fall if its engine thrust should suddenly fail at that exact instant. (It does no good to take readings after engines use up their fuel and quit, in normal operation, because even if the total missile is destroyed once in free flight, the pieces, like shrapnel, will land where the total bullet was already headed.)

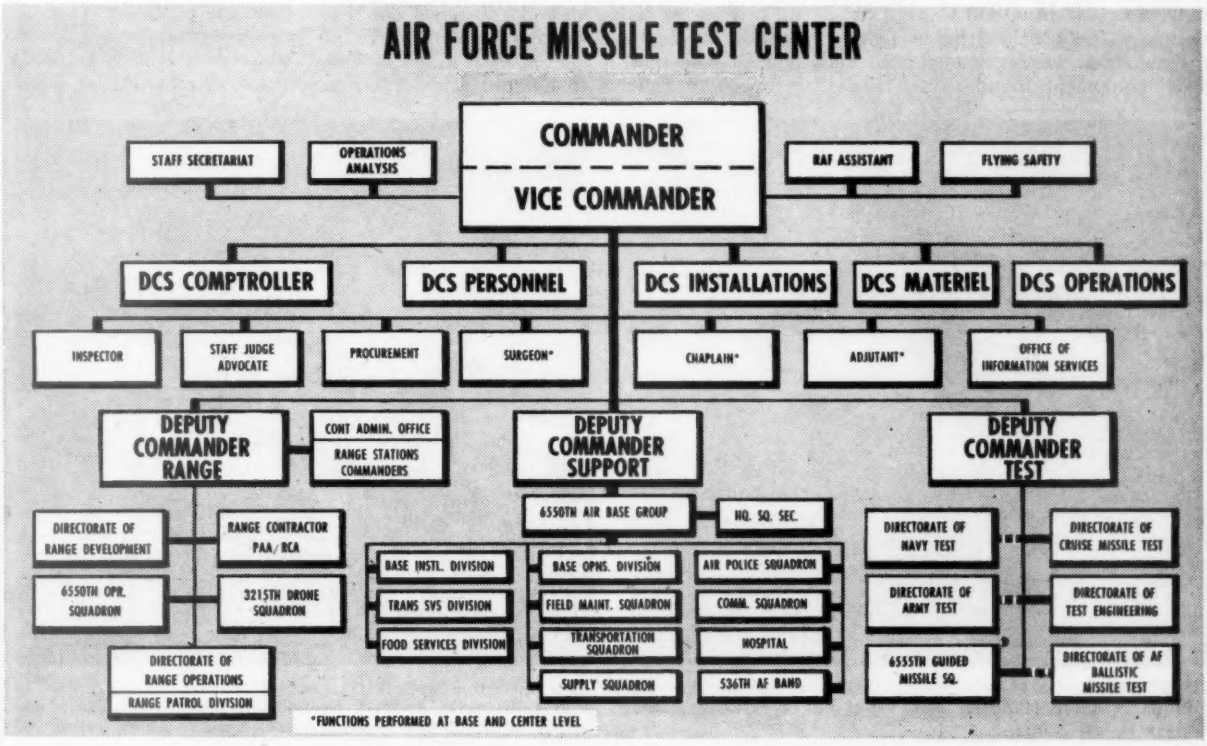
The system consists of a transponder carried in the missile and eight ground antennas, protected by pressurized plastic radomes, placed along two base lines in the form of a cross at a site on the Cape. The transponder receives signals from the ground station, switches them to another frequency and sends them back to the impact predictor station (on whose wall is a sign: "Around here things are not figured out. They're Engineered"). The returning signals are analyzed by complex electronic circuits using a trigonometric formula, then fed into an IBM 704 computer. Doing in an instant what would require a staff of mathematicians months to figure, the 704 fires its answers into Central Control, transmits them electronically to the plotting board. This equipment measures direction cosines to an accuracy of 2 parts per million, can detect a change in position of 15 to 30 ft. up to a range of 500 miles.*

Because the primary purpose of these laboratory experiments, *i.e.* missile firings, is to gather data, this is AFMTC's biggest job. About one-fourth of their information comes from cameras which range all the way from the Cape's own Recording Optical Tracking Camera (which can take a picture of a baseball eight miles away) to cameras at the downrange stations which record the terminal dive (or impact) of the missile when it dies.

The other three-fourths of the data comes from telemetry. The missile's payload is instrumentation (never armament) which reports on the performance of nearly every one of the missile's components. It is this instrumentation and not the missiles themselves which makes the long countdowns necessary, and is usually the cause of test 'failures"; *i.e.* if instrumentation does not work, they get no data. Typical of the data obtained from telemetry is altitude, attitude, battery, voltage, vibration, acceleration, temperature. Since the German development of the V-2, there has been at least

** A locally devised term for "Electronic Ground Automatic Destruct Sequencer," an electronic timing device which automatically selects and provides control for a number of command destruct (ground) transmitters so that, as the missile progresses in flight, it is under control of the transmitter which can most effectively "illuminate" it.*

** Statisticians recently evaluated how well the range safety officer has done his job. Using the results of eight years of testing, they came up with observation that a man sitting in a boat in the downrange area is more likely to be hit 10 times during his lifetime by lightning than he is to be hit once by a missile.*



an order-of-magnitude improvement in the techniques of data collection and analysis. Even on a ballistic missile flight of only 15 minutes, there are up to a quarter million discreet data points (individual readings)—instantaneous temperature, switch positions, pressures, velocities, etc.

The bulk of this data comes from the downrange telemetry stations, of which range station #3 at Grand Bahama Island is the largest, with just over 200 people. The average crew of the others is about 125 people with the exception of range station #2 at Jupiter Inlet, Fla., with only 12 people. Many of the stations are almost self-supporting, relying on Patrick only for logistics support, even distill their own fresh water from the ocean or trap it in rain catchments. All except Puerto Rico are on islands owned by another country, requiring State Department negotiation with foreign governments before they could be built.

The working parts of the typical station include a telemetry receiver (whose 80-ft.-high antenna is capped by a 60-ft.-wide dish), cameras, station communications timing signal generator (which ties together to a split-second all instrumentation at one or more stations), and a weather station.

Because there is a gap of some 2200 miles between stations #10 at St. Lucia Island and #11 at Fernando de Noronha and another of 1225 miles to #12 at Ascension Island, AFMTC maintains a fleet of 11 telemetry ships, modified Government cargo vessels ranging in size from 350 to 3500 tons, docked in Trinidad and Brazil. During a shoot, these vessels, loaded with the same equipment found at the island

Able, AFMTC Commander Yates.

stations, put out to sea, fill the gaps in the line, return to port after a test. Collected at Puerto Rico, the data is poured into the Cape data-reduction facility via an $18-million submarine cable.

There has been a rumor for some time that the range is to be extended to St. Helena Island. The Air Force answer is an emphatic "No." Main reason: the range can be extended now without a costly construction program merely by sending a telemetry ship down beyond Ascension Island.

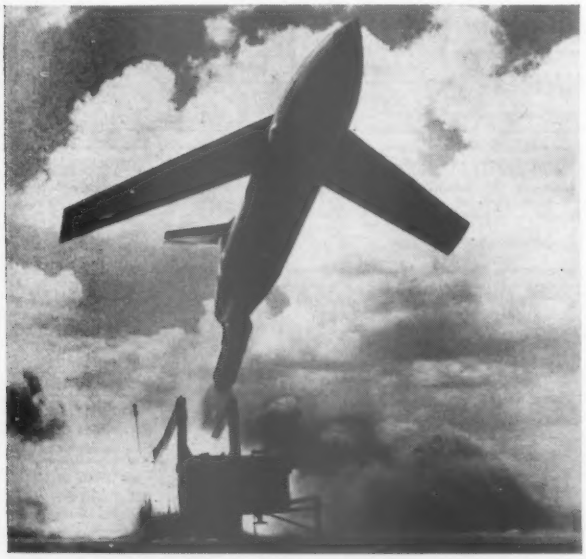
This operation goes on from early morning until well into the night on a two-shift basis at Cape Canaveral, where the Free World is not only testing missiles but taking the first steps in proving or disproving its theories on how to break the bonds of gravity and sail into space.

There are failures to be sure (such as a Bomarc which sprang a leak in its fuel tank, threatened to ignite and destroy the whole launch facility and had to be kicked off the pad) but Cape Canaveral is succeeding through failures, and missilemen grow hot under the collar over what they term the irresponsible use of the word "failure." In the outdoor laboratory (AFMTC does not build long-range missiles for anybody, but tests them for everybody), calling a test a failure is like saying Orville Wright flopped because he did not go all the way around the World when he took off from Kitty Hawk. Prime example: the first Atlas firing, which headlines labeled a dud, actually gave scientists 95 per cent of the test answers they were after.

Head man at this sprawling laboratory of the future is 48-year-old Air Force Major General Donald N. Yates. A 1931 graduate of West Point, he won his Air Corps wings a year later, picked up a Master of Science degree from CalTech in 1939.

Polished, even-tempered General Yates mixes science, business administration, missile strategy, public relations and politics with almost equal ease, often appears to Cape visitors to be an Air Force answer to Hollywood's Ronald Coleman. (Time magazine recently called him "able, urbane.")

At Patrick headquarters, he watches missile firings on closed circuit TV, gets direct phone reports from the Cape on the missile's programming. His impartiality in running the Center has caused at least one short-sighted Air Force Pentagon politician to accuse him of "sometimes wearing a green uniform." However, this fairness, probably more than any other factor, is one



USAF B-61 Martin Matador pilotless bomber, now operational, and its roadable launcher were debugged in extensive Cape Canaveral test firings.

This recording optical tracking instrument (ROTI), one of four going up at AFMTC, has 500-inch focal length, can photograph missile details several hundred miles away.

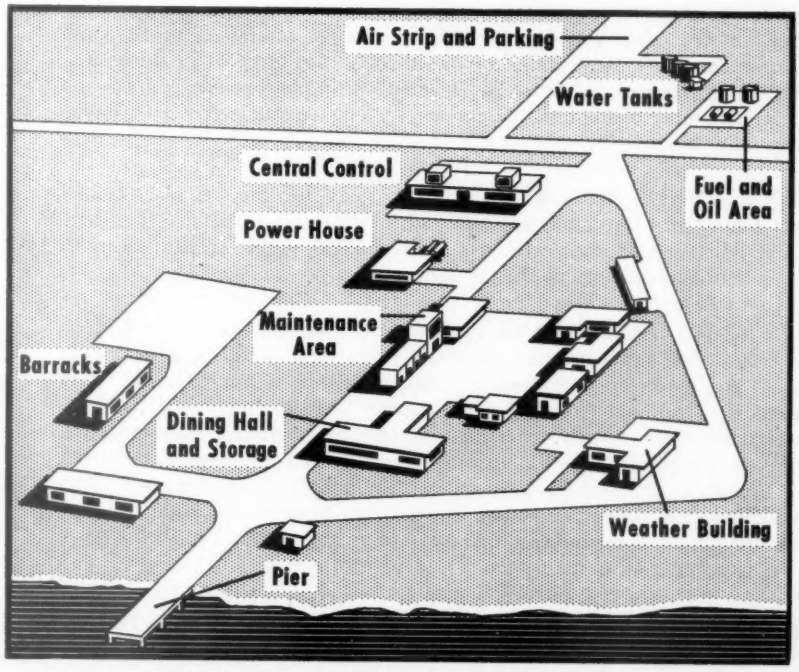
of the chief reasons he has managed to weld a smoothly working team out of a vast cross-section of people since taking AFMTC command in July 1954.

The Center's work force under his control now includes approximately 2000 civil service employees, 2000 military personnel (including Army and Navy), 5500 missile-contractor employees and about 6500 range-contractor people—and it's still growing. In addition, he has ultimate responsibility for 1500 to 2000 temporary construction workers (whose biggest jobs right now include building launch sites for Titan and Polaris). Present payroll runs about $6 million a month.

It costs Yates about $100 million a year (exclusive of what missile contractors spend) to run the center and he must use that to cover everything from aircraft maintenance (of the 42 aircraft which support the center's mission, including red-painted B-17s and QF-80 jet drones) to buying groceries.

There are plans under way now to expand the center's facilities to handle three missile firings at once. It is unlikely, however, that there will ever be three missiles launched at the same instant for a number of reasons. One: the IBM 704 at the impact-predictor site needs to be reprogrammed for each missile. This requires four-six hours. Two: About an hour before firing, a launch-pad area is cleared and sealed off. If three shoots were going on at the same time, this would tend to freeze all movement on the Cape. Three: there would have to be a vast duplication in telemetry, which right now can handle only one firing at a time. For ballistic missiles, whose flight will last only a few minutes, this means it's more likely they can refine the process to fire one possibly every half-hour; but the normal Snark flight ties up telemetry for as much as eight hours.

Some missile testers, like fighter pilots of another era, keep track of their progress by painting miniature missiles on the sides of launch stands. At the Air Force Thor site, for instance, one stand has five replicas painted on its upper deck. On the concrete floor a few feet away, for everyone to walk on, is another one, painted with an X through it in memory of one that failed.




Drawing shows typical downrange station setup.

Final phase of the test operation includes checkout, maintenance and firing of production-line missiles by military crews under field conditions, as SAC has already done at AFMTC with Snark. For, says General Yates, "No matter how well missiles perform under test conditions, they are useless to our forces until a military unit is capable of assembling, maintaining and launching them."

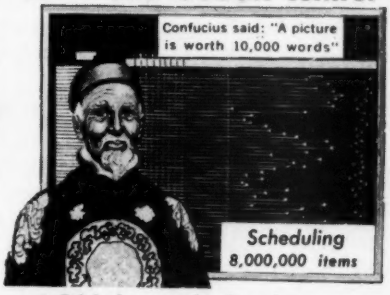
He added, "We are advancing steadily on all our missile programs, but it is a long, hard process that calls for all the technical skill we can muster. The explosions heard at Cape Canaveral and echoed in the press are measures of progress—not failure."


NAMES IN THE NEWS!

Jupiter!
Redstone!

Missile Development Centers are among the largest Government Defense users of Produc-Trol for research, production, manpower and other types of scheduling.

PRODUC-TROL
Visual Control
*not only schedules,*
*But* automatically checks with TIME, LINE and COLOR control




- Original cost and upkeep low.
- Schedules and time checks operations.
- Historical record to back it up.
- Bad situations show automatically.
- Its simplicity has put it into world-wide use.
- Analyze 100 items in 10 seconds.

Creator of Effective Tools for Effective Management

Phone Westport, Conn. CA 7-4111 or write
WASSELL ORGANIZATION, INC.
Westport, Conn.

IN USE IN ALL BRANCHES OF GOVERNMENT
WRITE FOR NEW BOOKLET "PRODUC-TROL"
or
Consult our GSA Federal Supply Service Contract Class 54—Part III—Sec. B—Cont. No. GS-00S-15367 GSA Distribution Code 7B & 7D Item No. 54-I-67S

For more facts request No. 5 on reply card.

# Washington Background

**SPEAKING OF PAY RAISES, THE CURRENT CONFUSION** over the retirement of Lt. Gen. Lemuel B. Mathewson, CG, Sixth Army, seems to revolve around nothing more than a desire to hang on until the pay bill goes through—to reap a big boost in retirement pay over what he would receive if he quit today. Army announced his retirement several weeks ago. His reaction: "Who, me?" Did he apply for retirement? Pentagon refused to answer, said only they would "announce his retirement again within next two months."

**PENTAGON IS BEGINNING TO FEEL THE PRESSURE** of a strong Congressional move, from several directions, to make some kind of uniform sense out of military security regulations—run at the moment on pretty much a unilateral basis by each Service. House has passed legislation specifically forbidding the Pentagon from using an ancient "housekeeping" law as an excuse for withholding information from the public. House Government Information Subcommittee has asked Pentagon to establish a uniform security system for defense contractors and scientists working for Government agencies. Conclusion of subcommittee's report on investigation of scientific information: "Defense Department's multiple clearance system has definitely delayed scientific progress." Pressures for change will get even stronger in next few months.

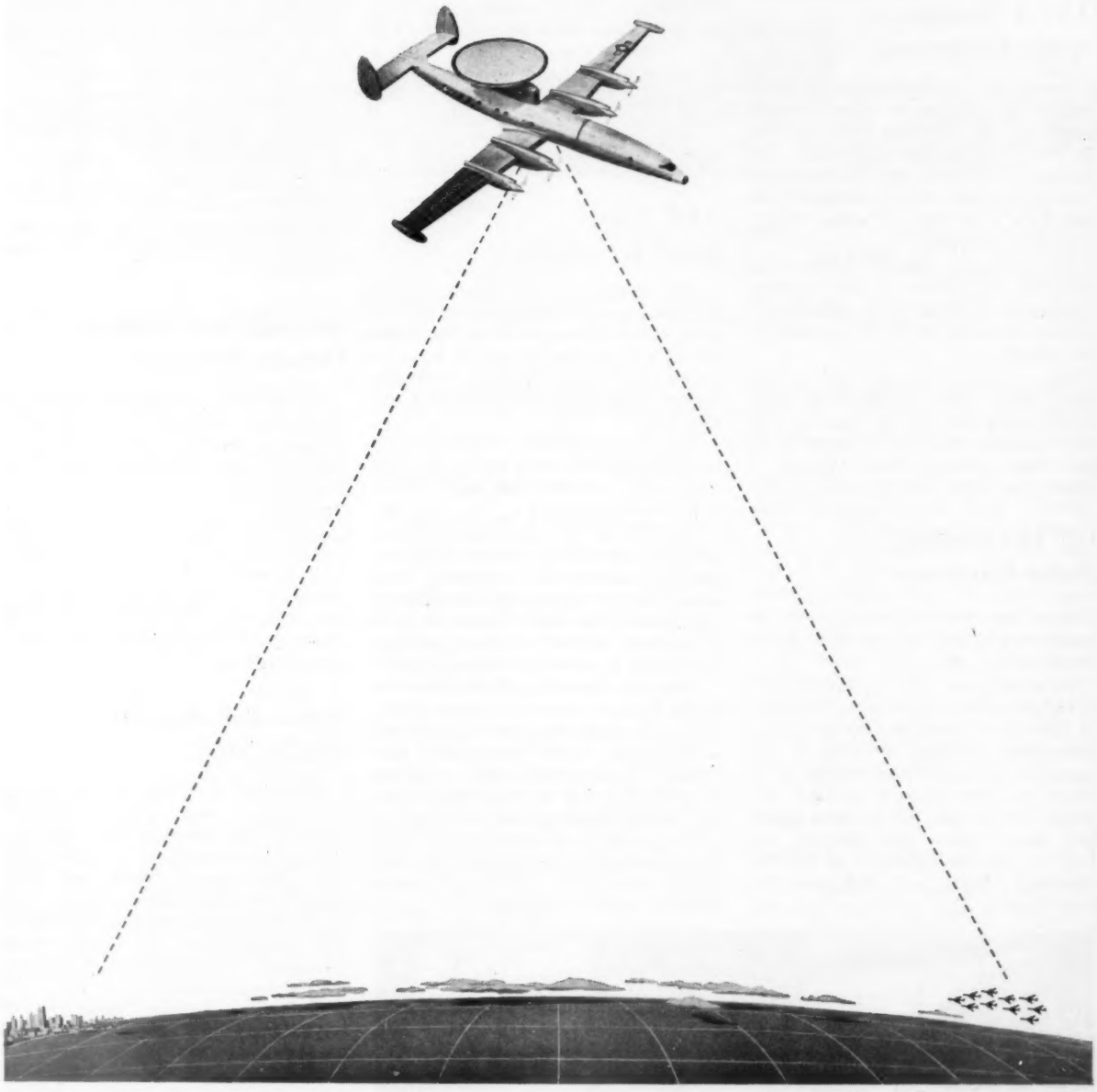
**BITTER IN-FIGHTING IN NAVY** is likely in next few months as advocates of destroyers and other antisubmarine ships battle advocates of carriers and aircraft for scarce dollars. Battle will get worse as fiscal 1960 budget-preparation time draws near. Antisubmarine boys, at the moment, have a point edge.

**ARMY'S ANNOUNCED PLANS FOR MAJOR REORGANIZATION** of its National Guard and Army Reserve units along Pentomic lines are in for rough sledding. Most controversial Army reorganization plan in recent months, idea is to "Pentomicize" National Guard, USAR, cutting NG divisions by six, USAR by four in next two and one-half years. State governors concerned must approve any Army tinkering with the 27 NG divisions, have already heard personal appeals from Army Secretary Brucker for support of the modernization program. Observers say outcome will prove one of two things: if it passes, NG is what it's supposed to be—an almost-combat-ready reserve Army; if it flops, critics will howl anew that NG is nothing more than a feeding trough for state political hangers-on.

**WHAT RANKLES TOP MILITARY MEN MORE THAN ANYTHING ELSE,** at the moment, about President's Eisenhower's Pentagon reorganization plan is not the plan itself but his order that they will not criticize the plan except in direct Congressional testimony—and even then must keep in mind their position in the Defense structure, *i.e.* their Commander-in-Chief is pushing the new plan hard. In spite of mollifying statements by Defense Secretary McElroy before the House Armed Services Committee, the rule still looks like a polite assertion that critical officers will be digging their own graves. Said one disgruntled general, "We've been told, in effect, we will not defend the present law, because he (Eisenhower) wants it changed."

**MOST OBVIOUS DANGER OF THE RULE,** say complainers, is its stifling of free comment by career military men whose future is tied directly to the outcome. On the other hand, they say, it gives free rein to a man who, in spite of outstanding administrative ability, could not possibly acquire comparable career knowledge in six months of service—"nor," said one bitter officer, "pick it up in a weekend sojourn to Puerto Rico with some of our former employees."

**EVEN SO, THE MILITARY WILL FIND WAYS** of letting off steam, replace bold statements with innuendos: as the "Pentagon parishioner" who said last week, "This reorganization plan reminds me a little of the scientist who tried to cross a rooster with a rooster. He got a cross rooster."



# SELDOM SEEN...ALWAYS THERE

A sneak attack on our nation with airborne nuclear weapons would be vastly more devastating than the holocaust of Pearl Harbor.

To safeguard the United States against surprise attack, Airborne Early Warning (AEW) aircraft patrol our outermost defense perimeters every hour of every day in all kinds of weather.

Equipped with radar that can "see" 150 miles (in all directions) through thickest fog or darkest night, these lonely AEW sentinels of the skies are seldom seen by the people they protect, but at the first hint of possible danger, they will flash a warning to our great Strategic Air Command, our mighty fleets and world-wide retaliatory striking forces.

*America's safety depends on keeping our Airborne Early Warning patrols at optimum strength and efficiency.*

**LOCKHEED *means leadership***

CALIFORNIA DIVISION, LOCKHEED AIRCRAFT CORPORATION, BURBANK, CALIFORNIA

## ARPA Assigns Space Programs

Somewhat prematurely, "because public interest . . . in space exploration is so high," Defense Secretary Neil Hosler McElroy has announced the Advanced Research Projects Agency is proceeding with several programs for launching a number of small, unmanned space vehicles.

ARPA Director Roy W. Johnson has allocated $8 million to the agencies concerned to begin work, although it is much too early to put a timetable on the effort.

The programs include: one or two moon shots (lunar probes, in the technical vernacular) and the launching of two, possibly three, earth satellites by the Army Ballistic Missile Agency at Huntsville, Ala. The Air Force Ballistic Missile Division, ARDC, has been assigned three more lunar probes, will use a Thor-Vanguard system with a third stage to be developed. Meanwhile, the Naval Ordnance Test Station, Inyokern, Calif., will develop a mechanical ground-scanning system for use, when available, in lunar probes.

## AEC Plans Food Irradiator

The Atomic Energy Commission and Department of Defense plan to build a large cobalt-60 gamma food irradiator which will become a part of the projected U.S. Army Ionizing Radiation Center at Sharpe General Depot, Lathrop, Calif.

The gamma facility, to be built by an industrial firm (still to be decided) under AEC contract, will be known as the High Intensity Food Irradiator (HI-FI). It will be used by the Army Quartermaster Corps in connection with its food preservation project, replacing the Food Irradiation Reactor previously proposed as the gamma radiation source for the Center. Source of the gamma facility's radiation will be approximately two million curies of radioactive cobalt-60, an amount several times greater than the approximate 350,000 curies of cobalt-60 now in use in the U.S.

## GE Developing Solar Furnance

Man has taken a lesson from the sunflowers to help him push back the frontiers of space.

Pictured here is a solar furnace equipped with a sun-tracking heliostat to keep the furnace pointed at the sun throughout the day. Working on the principle of a sunflower, which is reputed to keep its face pointed constantly at the sun, this heliostat-equipped solar furnace was designed and built by missile engineers in General Electric's Missile and Ordnance Systems Dept.

Installed in the department's Aerosciences Laboratory, where high-temperature studies are conducted with many types of extreme heat-producing equipment, this solar furnace is used to conduct relatively high-temperature studies in a controlled atmosphere.

The solar furnace pictured here was made from a converted Army searchlight. GE engineers added the crossed metal beams to hold the cylinder containing the specimen and a quartz chamber that can be evacuated to permit testing specimens in a vacuum.

Temperatures achieved with a solar furnace using a searchlight for the heat source are about 5000°F and about 6000°F using the sunlight.

## Surveillance System Details Released

Design of a new all-weather surveillance drone system, utilizing the SD-2 drone, to provide combat unit commanders with information regarding the battle area, has been announced by the Army.

Currently being designed and developed by the Rheem Manufacturing Co., models of the SD-2 drone are scheduled for delivery in July for flight and evaluation tests at the U.S. Army Electronic Proving Ground, Fort Huachuca, Arizona.

## Space Bill May Be Out in May

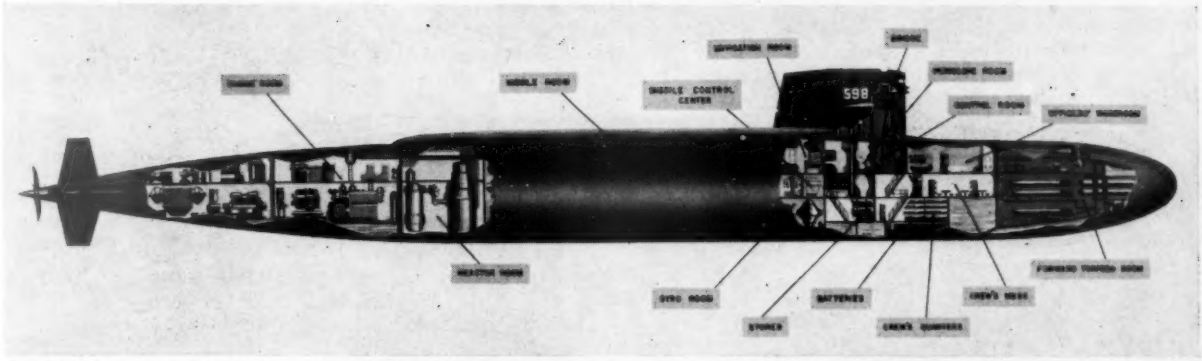
Optimistic forecasts by the House Astronautics and Space Committee have the unit reporting out a bill early this month establishing an independent civil space agency. There have been published reports that the group is expected to approve President Eisenhower's proposal for an agency built around the National Advisory Committee for Aeronautics.

A staff spokesman, however, observed that opinion is not unanimous on this point. He said some committee members are reluctant to destroy the important advisory capacity of NACA. To put the proposed agency in line with the President's request, Congress would have to give its director contractual authority, making it an operating agency.

## Test Facility Construction Pushed

The Navy is rushing completion of its $23.5-million Naval Air Test Facility at Lakehurst, N.J.

Test center will be used to develop launching and recovery systems for the new supersonic aircraft which will operate off nuclear-powered and conven-




**Detailed design of the nuclear-powered fleet ballistic missile submarine is shown in this cutaway drawing released by General Dynamics Corporation's Electric Boat Div., which will build two of the vessels. Subs will be able to fire Polaris missiles, are 380 ft. long and have a 5600-ton displacement.**

tionally powered supercarriers. Two of the major problems to be faced at the 4500-acre installation are developing a catapult system powered independently of ship's boilers (since nuclear-powered carriers cannot build up the necessary high steam pressures); and evolving high-speed landing recovery systems for tomorrow's heavier, faster aircraft.

## Army Develops Infrared Alarm

An infrared "eye" so sensitive it will detect evaporation from one droplet the size of a pinhead in an average living room has been developed by the U.S. Army Chemical Corps as a new protective device against chemical-warfare agents.

Intended for use by troops in the field, the new device, known as LOPAIR (for long-path infrared), will flash a warning light and sound a horn when a tiny amount of contaminant in the air, as far as one quarter of a mile away from the "detector head," crosses an invisible infrared beam. LOPAIR will detect contaminants even if they are colorless and invisible to the naked eye, as most potential toxic warfare agents are. In combat, it would warn soldiers to put on their protective masks.

## Navy Unveils New Aircraft Gun

An aircraft under-wing gun container, carrying a double-barreled 20-mm automatic cannon with eight times the firing rate of its World War II counterparts was unveiled at the Naval Air Weapons Meet by the Navy Bureau of Ordnance and the Aircraft Div. of Hughes Tool Co.

The container, or pod, attaches to and detaches from the aircraft by means of two simple connections in a matter of seconds and can be instantly jettisoned in flight by the pilot. Two of these pods and guns can equip a plane with the firepower of 16 World War II 20-mm cannon.

## Test Chambers Shipped to France

Four giant environmental test equipment chambers, together weighing more than 31 tons, have been shipped recently from Tenny Engineering, Inc., to France for use in the French Air Ministry's missiles, rocketry and supersonic-aircraft development program.

The four units can simulate almost any climatic condition on earth and in the stratosphere. They consist of a walk-in combination altitude, temperature and humidity chamber; a small component altitude, temperature and humidity chamber; a sand and dust chamber; and an explosion chamber.

## Army to Test RCA Radar

The Army has awarded a contract to Radio Corporation of America for installation of the AVQ-50 lightweight weather radar system on an Army H-21 helicopter. The installation will be used to evaluate potential use of the radar in the Army's aviation program. Weighing only 50 pounds, AVQ-50 enables pilots to "see" and avoid storms at distances up to 80 miles.

## Propellant Research

Major Gen. Donald M. Yates, commander of the Air Force Missile Test Center, Cape Canaveral, said recently the dispute over the respective advantages of liquid and solid propellants could not be resolved easily, *i.e.* neither had a clear-cut advantage over the other in all possible uses. Briefing a group of the Nation's leading newsmen, he added, chances are both types will continue to be developed indefinitely or until something better—possibly a gas propellant—comes along.

He also denied the prevailing opinion that liquid-propellant missiles have a slow reaction time. Actually, he said, the reaction time of operational ballistic missiles can be "very short," well within the estimated 15-minute warning the U.S. would have in case of an intercontinental missile attack. Reason for the long countdowns being used now is the almost unbelievable amount of instrumentation carried in the missile, which has to be checked before firing, solely to test the behavior of the missile components during a firing.

## Army Sets Up Research Office

The Army has established an Army Research Office at Fort Belvoir, Va. The office, staffed by military and civilian scientists, will coordinate the Army's research efforts, provide a central point of contact with the civilian scientific community. Primary job: "Continued and rapid acquisition of scientific information."

## Pilotless Helicopter System Ordered

Gyrodyne Company of America has requested Lear, Inc., to build a prototype remote-control system for the Gyrodyne XRON-1 Rotorcycle.

The Rotorcycle, a coaxial-rotor one-man helicopter, will be fitted with a Lear automatic flight-control system, which in turn will be radio-controlled from the ground. Lear, with responsibility for developing both the flight-control system and the adaptation of an existing radio control link, will deliver two prototype systems in early Fall. Mission for which the control system is being developed is classified.

*The only product of an Ordnance product test is a test report. The problems and procedures in getting that report are outlined here in . . .*

# How the Army Tests at Aberdeen

**by Col. John D. Armitage**
*Director, Development and Proof Services*
*Aberdeen Proving Ground, Md.*

THE mission of a proving ground is to provide a facility for, and to conduct, those tests and related operations necessary for the evaluation of that materiel for which it has a testing responsibility. It must ever be prepared to meet the challenge of an advancing technology, both in the Ordnance items submitted for test, and in the equipment, instrumentation and facilities necessary for the test operations. Just as important, it must have available a staff of well-trained and experienced personnel, technically qualified to plan and conduct test operations and to evaluate the materiel tested.

Before an item is subjected to proving-ground tests, the following sequence of events has usually occurred. An individual or agency has conceived an idea; a designer has put the idea on paper; the idea has been fabricated into a piece of equipment. The testing agency then puts the item to test to determine if the basic idea and the manufactured item have merit and will perform adequately the function for which intended.

Testing of a new item may be a simple job, requiring but little manpower, a few tools and a place to work. More often, however, the problem is complicated by the need for close cooperative endeavor by many agencies and individuals, special and expensive instrumentation and unique test facilities. In the Ordnance Corps, the experimental laboratories, the manufacturing arsenals and the proving grounds work in close harmony on such problems, all under the direction of the Chief of Ordnance.

Proving-ground testing usually falls into three main categories—development tests to prove the value of an idea, engineering tests to evaluate the worth of the manufactured item, and acceptance tests to insure that a standardized item complies with the manufacturing specifications. To accomplish these tests, two functions are needed—technical services to conduct the actual testing operations, and the administrative services to provide the support required to keep the technical function in operation.

It is in the technical, not the administrative, function that most proving-ground problems are encountered. The variety and complications involved rule out any possibility of production-line testing except for the acceptance function. It is not possible to limit one man to a specific test operation. It is sometimes practicable to assign an engineer to a particular field of operation, but in that field he must be able to adapt himself to a wide variety of conditions. For instance, an engineer in the field of gunnery must be able to test and evaluate many different types of gun tubes, breech mechanisms, firing mechanisms and muzzle attachments. At the same time he must be familiar with the entire gun mount, recoil system and many other appurtenances.

Ordnance engineers as such are not graduated from college. Rather, they are developed from graduate civil, mechanical, electrical or chemical engineers. An individual with a natural technical inclination may develop into a good proving-ground test engineer, but Ordnance 'know-how' comes only as a result of long experience in the field.

Facilities and instrumentation required for test operations offer what is probably a proving ground's most critical problem. Even though Aberdeen has many special firing ranges, automotive test courses and laboratory facilities, each new item or new requirement from the Army's using agencies often requires the construction of new facilities or extensive adaptation of existing facilities. Instrumentation found on the open market is frequently adequate for proving-ground use; more often it is necessary

or more expedient to devise and construct instrumentation as the need arises.

Having facilities available for testing is but half the problem. The special automotive test courses—the washboard, mud, sand and water courses; the crosscountry, hard surface, and gravel roads; the mud bath and the water bath—must be maintained and kept in first-class condition to avoid compromising test results. For instance, the special soil bed employed in mobility tests must be composed of a combination of soils mixed in specific proportion; the moisture content of the course must be at the desired level; and before the test is run, the course must be harrowed and leveled to obtain the desired consistency and contour. Then, too, to make test conditions on the courses equivalent to those found in actual service, continuing modernization of the facilities is essential.

Still other problems exist in the operation of firing ranges and bombing fields. The impact areas must be maintained in a cleared and level condition to enable observers to spot the point of impact and, when required, to recover the projectiles. Safe shelters must be provided for observers at the impact area and for the gun crew back at the weapon. Explosive material must be processed, transported and handled in strict accordance with safety regulations. Although all operations with explosive material are inherently dangerous, the proving grounds have had an admirable safety record in both war and peace.

When setting up a test program, close liaison must be maintained between the test engineer and the instrumentation laboratories. Communication lines, chronograph setups, instrumentation installations on the test item—all must be planned, coordinated and accomplished before starting a test. Development items are essentially handmade and therefore costly in time as well as dollars. Since many tests are of a destructive type, every care must be taken to insure that each person supporting the program understands the requirements and that the data necessary for the evaluation of the item undergoing test is obtained on each test event.

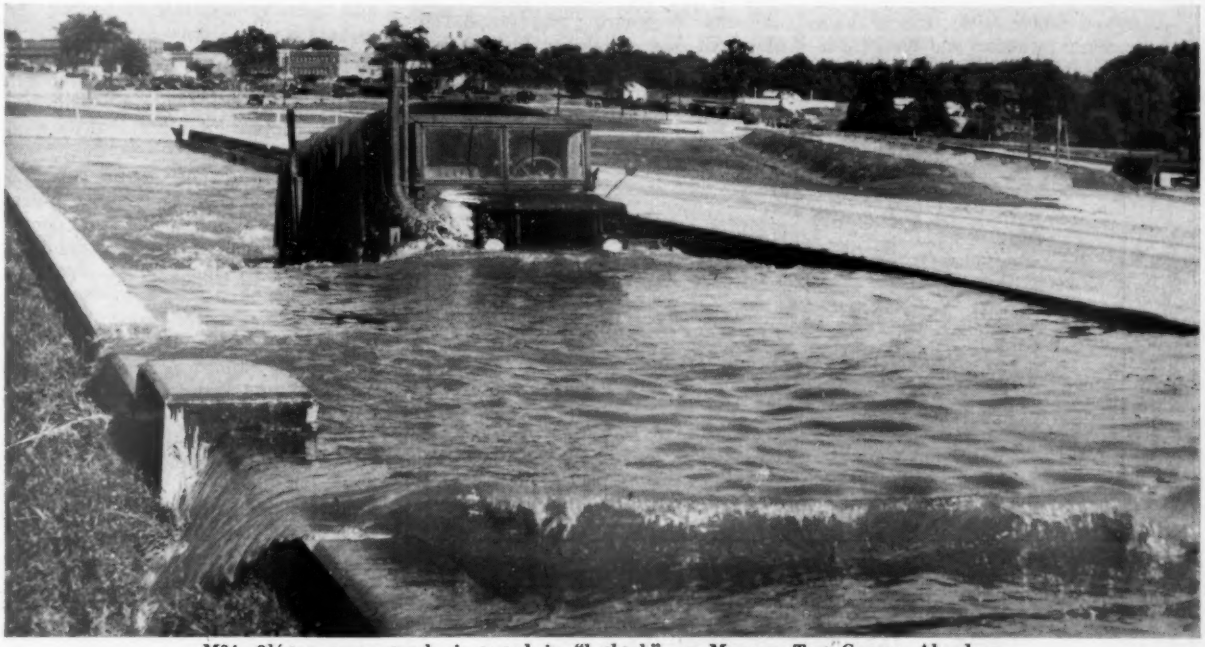
Test operations frequently become involved in the field of public relations. Aberdeen Proving Ground is situated in a densely populated area. Two towns, Aberdeen and Havre de Grace, are located within a 10-mile radius, and the city of Baltimore is only 30 miles away. Meteorological conditions are carefully observed and evaluated for programs which would cause excessive noise or disturbances to be focused on an off-post area.

The movement of heavy test vehicles on public highways is also a problem. A large tank fitted with grousers cannot be driven to a nearby off-post test course without causing extensive damage to concrete and macadam highway. As a result, it is necessary to transport such vehicles to their destination by using tank transporters or rubber-padded tracks.

A most sensitive problem for the proving ground is the absolute necessity for standardized procedures and reproducible test conditions. To solve this problem, Aberdeen Proving Ground is charged with the publication of the Ordnance Proof Manual, which provides procedures for the test operations employed at all proving grounds. This publication is composed of four volumes—Vol. I, Arms and Ammunition Testing; Vol. II, Automotive Testing; Vol. III, Small Arms Ammunition Tests (published by Frankford Arsenal); and Vol. IV, Ordnance Test Instrumentation. In addition, a series of Acceptance Test Procedures provides the information required for acceptance testing of specific items.

The only product of an Ordnance proving-ground test is the report on that test. It is vital that proving-ground reports be complete and concise, that they supply the information needed for the final evaluation of the product under study, and that they be published and distributed without delay. The designer, the manufacturer and the directing agency need early information on a project to save valuable time and material and to keep developments of sorely needed items on schedule.

By keeping abreast of the developments in Ordnance through good communication with those agencies which they serve, and through the constant training of qualified personnel and technological advances in instrumentation and other equipment, the proving grounds will continue to perform an exacting and invaluable service for Ordnance and the Line.



**M34, 2½-ton cargo truck, is tested in "bathtub" on Munson Test Course, Aberdeen.**

# Why the Air Proving Ground Center Is Changing Its Operation

by Maj. Gen. Robert W. Burns
*Commander, Air Proving Ground Center, ARDC*

***The changing technology of war has presented the most challenging of operating problems to the testing and proving grounds of this Nation. The Air Proving Ground, which is the largest U.S. Air Force facility engaged in the testing of weapon systems, is now in the final stages of a reorientation to meet these changing concepts and techniques of testing.***

AS HAS been previously announced, the Air Proving Ground is no longer a separate command. It is a center integrated into the Air Research and Development Command and known as the Air Proving Ground Center (APGC). In retrospect, I feel that the current reorientation of APGC is logical in our changing times.

One of the specific factors involved in this reorientation can be identified as the increasing complexity and the associated increasing cost of test items. Missiles are largely replacing bullets and bombs and the testing methods applicable to the latter are no longer valid. Today's testing techniques require the maximum data from each item expended.

A second factor mitigating in favor of a reoriented mission and reorganization at the Air Proving Ground is the production methods common in the defense industries of our Nation. Once production starts it is costly to slow down or hold back. An Air Force testing cycle which cannot keep ahead of the production line, for any reason, delivers the last research and development (R&D) test items, the employment and suitability test (E&ST) items, and the initial equipments to the using command before all deficiencies are overcome. The inevitable results of such a situation are time-consuming and costly retrofit programs. It is therefore much in order that testing establishments streamline their methods, eliminate unnecessary duplication and determine corrective actions for the item as soon as possible.

A third consideration which had bearing on the reorientation is the difficulty in securing the proper employment and suitability test environment early enough to influence the final configuration of systems being produced. Rapid technological advance has produced abrupt changes in weapon system types which require unique test facilities. For example, the facilities required to properly test the F-89D interceptor, the F-102 interceptor and the Bomarc interceptor-missile are vastly different. Many future weapon systems, such as the IRBM and ICBM, require expensive installations. The cost of creating these for separate employment and suitability testing is obviously so high that the problem became one of deciding whether to run this type of test in conjunction with the R&D testing or with the first unit of the operational command. This blending together of R&D, E&ST and initial user tests and training helped to point the way to a basic change in the testing philosophy of the Air Force.

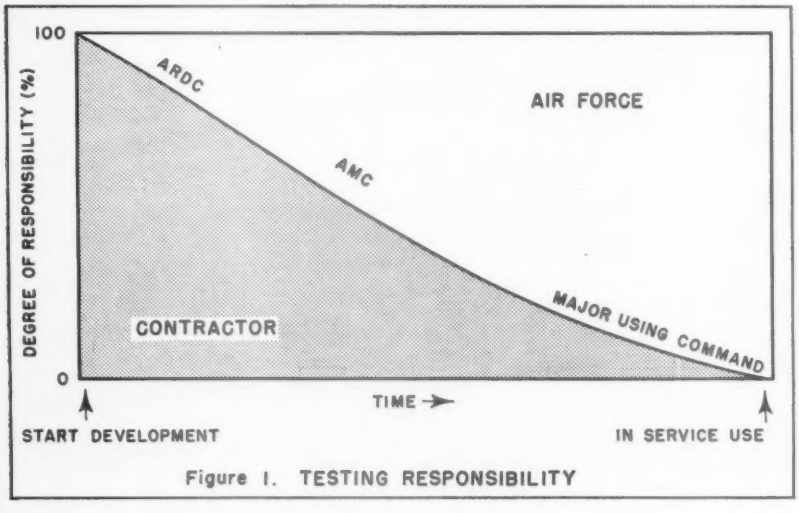



Figure 1. TESTING RESPONSIBILITY

## Background

Approximately coincident with the creation of the Air Research and Development Command, a testing philosophy (AFR 80-14) was promulgated to guide all activities engaged in R&D and operational-suitability testing. Appropriate to the times, this philosophy was slanted mainly toward the testing of airframes and engines antedating the weapon-system concept. This testing philosophy established seven numbered phases.

With the advent of the weapon-systems concept, it was recognized that the airframe-powerplant combination was no longer the dominant factor in achieving combat capability. Other subsystems, such as the bombing-navigation or the fire-control, were equally critical in the R&D process and were requiring more time and more dollars to fabricate and test than the previously dominant airplane. In spite of this, the testing philosophy as expressed in AFR 80-14 remained substantially unchanged, although certain terms—such as Phase IV, "Performance and Stability"—obviously applied to the older concept.

Following this, the testing of missiles with their highly integrated subsystems introduced similar problems when attempts were made to apply

the seven phases of testing. As a result, the USAF and its commands (specifically Air Research and Development Command (ARDC), Air Materiel Command (AMC) and APGC) had been trying to apply an old concept to fit the complex manned and unmanned weapon-system tests into the seven (finally increased to eight) compartmented phases of 1951.

Experience has shown that research and development testing is not conducive to the sharp divisions or compartments described in AFR 80-14; it resembles, rather, a spectrum and involves much blending between phases. Frequently a test, designated as Phase IV, for example, ended up as a Phase III design-refinement test although this did not become clear until well along in the test cycle.

The blending of test phases one into another in a logical and compatible manner is one of the most challenging management tasks in the R&D process. It requires a special skill derived from experience in testing similar items and from an early working knowledge of the item to be tested. It is best accomplished by a center specialized in testing, and calls for early introduction of test-center personnel into the development cycle. Testing does not logically follow development: it is an integral of it. The logic of having one command with authority over the development and the entire test spectrum for timely and economical (nonduplicating) testing becomes obvious under this concept.

## New Concept

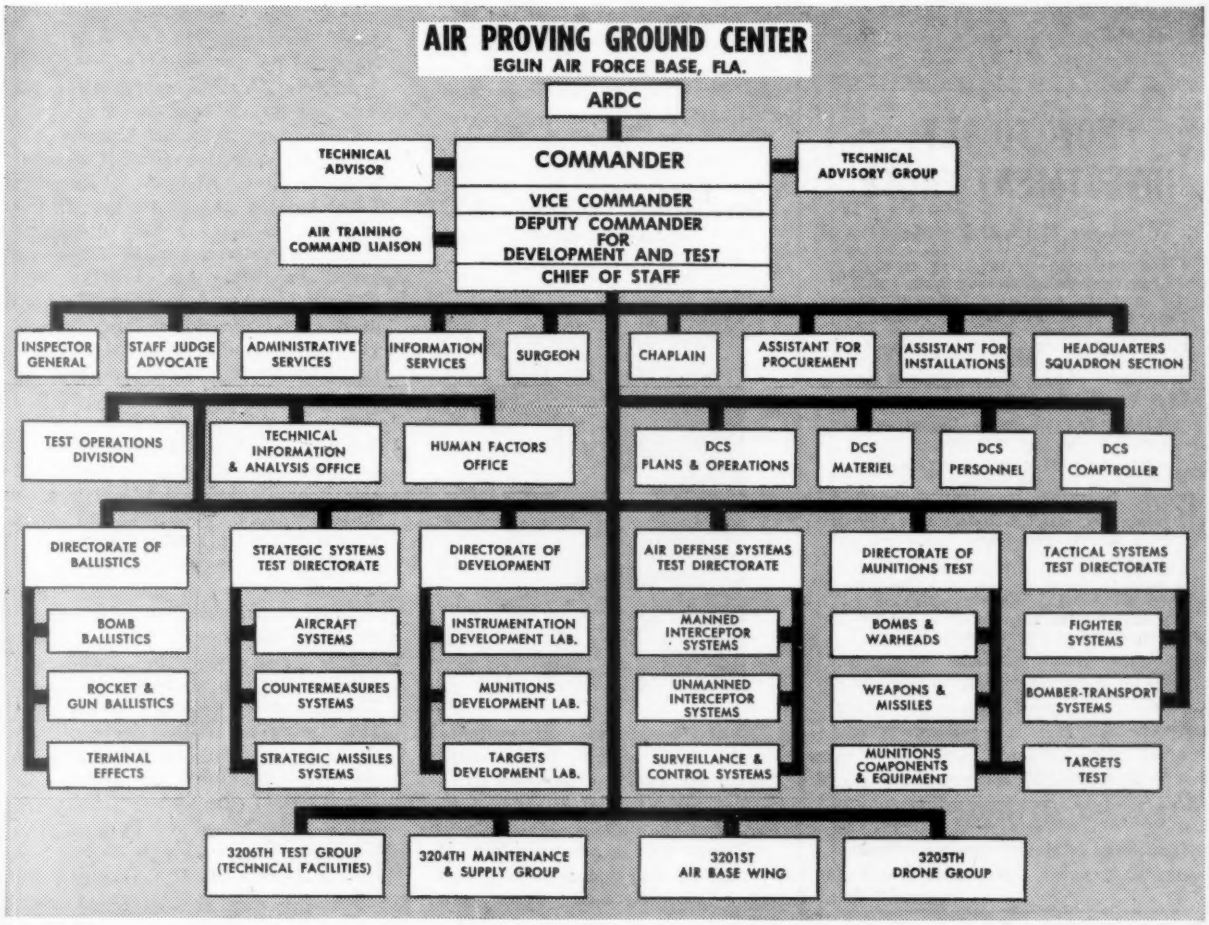
The new testing concept, with its blending of the old compartmented phases into a single spectrum with four broad categories, obviously places four activities into a much closer working relationship. These are the contractor, ARDC, AMC and the major using command. As component or system testing proceeds to a point where feasibility has been proven, the Air Force should come into a partnership relation with the contractor. Such joint contractor-ARDC testing eliminates much duplicate testing, since one mission can satisfy the requirements of both parties if it is properly planned and executed.

When the debugging operation of the item is sufficiently far advanced so that a "get well" date can be forecast, the contractor should release the test-team captaincy to the Air Force and assume a secondary role. ARDC becomes the initial team leader for the Air Force and is supported by AMC and the major using command.

Later, as the equipment nears operational status, the using command becomes increasingly active and may take over test control from ARDC on joint tests as the contractor phases out. It should be apparent that such a philosophy can save much time and cost in testing complex weapon systems. These general relationships are depicted in Fig. 1.

In line with this basic philosophy and a pending revision of AFR 80-14, a decision was made to merge the Air Proving Ground Command, which specialized in Phase VII and VIII testing, into the Air Research and Development Command. The Air Force Armament Center of ARDC, which had been a tenant of APGC at Eglin Air Force Base since 1952, was merged into the new Air Proving Ground Center as of 1 December 1957. The mission of the new center is expressed briefly as follows:

To conduct, participate in and/or



support systems-engineering evaluation tests as directed.

To conduct development, with primary responsibility in munitions and associated equipment (except nuclear).

To conduct development of aerial targets and scorers.

To conduct testing in support of the primary development mission.

To be responsible for development of Air Force ballistic tables and associated ballistic theory.

To conduct early development testing of fire-control, bombing-navigation subsystems and components.

Among special responsibilities under this mission are:

Continued operation of the Climatic Laboratory.

Provision of drones for Air Force, Army and Navy testing and training purposes.

Periodic firepower demonstrations and management of all Air Force air demonstrations.

The effect of the new concept of testing, the merger of AFAC into APGC, and that in turn into ARDC with a new mission will produce a substantial manpower saving. Specifically, the reduction is from 11,988 to 8155, to be achieved by the end of the current fiscal year. Increased contractor activity at Eglin Air Force Base will offset to some extent the decrease in Government personnel. The problem of reorienting the facilities and organization at APGC to the new mission has been undertaken with a view to future as well as present workload and capabilities.

## In the Future

Looking ahead, the Air Proving Ground Center will man and operate the new Eglin Gulf Test Range for the testing of air-to-air, air-to-ground and ground-to-air weapon systems. Specific systems committed to testing on the range are Rascal, Bomarc, Falcon, Sidewinder and similar missiles. An Air Force Missile Employment Facility is now under construction on the Eglin Reservation. The Strategic Air Command, the Air Defense Command and the Tactical Air Command will participate with the Air Proving Ground Center in future tests and also use range time for training. The range is being equipped with FPS-16 instrumentation radars to give engineering quality test data. There are many other advanced instrumentation devices included in this range complex.

The Experimental SAGE sector under construction will give this center a unique capability to test all air defense interceptor systems which are designed for integration into a SAGE environment.

In addition, this center, in accordance with ARDC policy, is considering the potential of its facilities and capabilities to support the space-vehicle program. The vast area of the Gulf coupled with the 800 sq. mi. in the Eglin Reservation and its in-place facilities appear to offer much in support of such a program.

With these various factors taken into account, the new organization of the Center was placed into operation on February 1, 1958. Fig. 2 shows the new organization structure.

As the Air Force implements its new testing philosophy, the Air Proving Ground Center has a vital role in maintaining superior air power by testing new aircraft, armament and missiles at Eglin.

### About the Author

Robert Whitney Burns was born in Stanley, Wis., in 1908, attended the University of Wisconsin for two years, and began aviation cadet training in 1928 at March Air Force Base, California.

General Burns, in February 1948, became special assistant to the Deputy Chief of Staff for Personnel and Administration at Headquarters U.S. Air Force. Three months later he

was named chief of staff for the Eighth Air Force, with Headquarters at Carswell AFB, Fort Worth, Texas.

In October 1948, General Burns was appointed chief of staff of Air Training Command at Barksdale AFB, Shreveport, La. A month later he was appointed deputy commanding general of Air Training Command, was later designated vice commander of ATC at Scott AFB.

In June 1951 General Burns was appointed Assistant Deputy Chief of Staff for Operations at Air Force Headquarters, became Assistant Vice Chief of Staff of the Air Force in May 1953.

General Burns assumed command of the Air Proving Ground Command in June 27, 1955. He commanded the Air Proving Ground Command until 1 December 1957, when the command merged with the Air Force Armament Center at Eglin Air Force Base to become the Air Proving Ground Center under the Air Research and Development Command. On that date he assumed command of the new Air Proving Ground Center.

General Burns has been awarded the Bronze Star, Air Medal with one Oak Leaf Cluster, Legion of Merit and Distinguished Flying Cross. His foreign decorations include the French Croix de Guerre, the Chilean Order of Merit (First Class), the Order of the British Empire and the Belgian Croix de Guerre. He is rated a Command Pilot and Technical Observer.


**HOW TO GET INVESTMENT FACTS**

***about Mutual Funds***

**I am interested in investing through the Mutual Fund method and would like to start a personal investment program in one or more Mutual Funds.**

**Please send me detailed information on a Mutual Fund which (within market risk limits) seeks the objective best defined by: (Check one)**

- ☐ **CONSERVATIVE TYPE—Capital conservation, modest income.**
- ☐ **MIDDLE-OF-THE-ROAD TYPE—Emphasis on current income.**
- ☐ **AGGRESSIVE TYPE—Emphasis on possible growth of capital with current income secondary.**

**I understand that full information will be sent to me at no cost or obligation when I mail this advertisement; and that information is to guide us. Achieving objective is not assured.**

**Name** .....

**Address** .....

.....

**BROWN, MADEIRA & CO.**

**Specializing in Mutual Investment Funds**

**One Wall Street, New York 5, N. Y.**

AM-17

**For more facts request No. 6 on reply card.**

## Sylvania Names Plato Project Manager

Sylvania Electronic Systems has named William N. Snouffer as project manager of the PLATO anti-missile missile system. Snouffer, for 20 years an Army and Air Force officer, graduated from West Point in 1937, holds a master of science degree in electrical engineering from the University of Illinois.

PLATO Pilot

The PLATO project, a mobile anti-missile system for field Army defense, is being designed to use the Nike-Zeus missile in defense of oversea military installations. Sylvania, prime contractor and weapons system manager on the project for the Army Ordnance Corps, has been working on PLATO for almost two years. The multimillion-dollar program is under technical supervision of Redstone Arsenal, Ala.

## Service Academy Supers Meet

Net result of a mid-April meeting of the superintendents of the four military academies (Lt. Gen. Garrison H. Davidson, West Point; RAdm. W. R. Smedberg III, Annapolis; Maj. Gen. James E. Briggs, Air Force Academy; and RAdm. Frank A. Leamy, Coast Guard Academy) was to throw a damper on any possible move to increase specialized instruction at the academies' undergraduate levels.

Their published, jointly stated opinion:

"In the foreseeable future the Service Academies should continue to provide a broad basic education in the humanities and social sciences as well as in mathematics and the physical sciences; professional education and training designed to equip the student for a career in his chosen service and at the same time to familiarize him with the concept of total defense and national security; a way of life that instills in the student the highest standards of personal conduct and the ideals of devotion to duty and dedication to the service of the Nation that have been the hallmarks of the American military profession.

"It was agreed that these fundamental objectives should not be sacrificed to provide vocational specialization at the undergraduate level. Any changes that may be in order should be designed to eliminate specialization in favor of strengthening basic education and the development of character and the qualities of leadership."

One other result of their meeting was a proposal to extend the system of exchange visits by cadets and midshipmen to include the Coast Guard and Air Force Academies.

## Air Force Expands Missile Training

To have qualified personnel on hand as missiles become operational and to cut down Air Force reliance on industry for training, the Air Force has expanded its missile-crew training programs.

Individual and crew training, involving 20 to 25 types of courses extending from two to 30 weeks, are presently being conducted by AF in such fields as propulsion, fueling and electronics. To accomplish these programs, AF has relied heavily on its prime contractors and on existing AF aircraft skills. Aid in training missilemen has been provided by Douglas Aircraft Co., Boeing Airplane Co., Northrop Aircraft, Inc., North American Aviation, General Electric Co., General Motors and Bell Telephone.

## Antisubmarine Training Begun

Admiral Jerauld Wright, U.S. Atlantic Fleet Commander in Chief, has formed a special task group to do advanced antisubmarine training work.

Designated "Force Alfa," the group will be commanded by Rear Admiral John S. Thach, will be composed of an aircraft carrier, a helicopter squadron, destroyers, shore-based patrol aircraft and submarines.

The new group differs from regular hunter-killer forces because it will have semipermanently assigned units and the units in the group will work solely on antisubmarine warfare training.

## Stevenson To Polaris

William A. Stevenson, one of the country's outstanding missile designers, has been named to direct design of the Navy's Polaris ballistic missile, being developed by Lockheed Missile Systems Division.

Stevenson moves to Lockheed from Convair, where he was chief engineer of advanced missile projects. He will be in charge of structural and internal systems design of the missile itself. The position, assistant division manager for missile design, was created to help speed development of the Navy's top-priority weapon.

## Science Students On Navy Cruise

About 150 students chosen at science fairs throughout the country will "join the Navy" for five days this fall as Navy Science Cruisers, it has been reported.

The students will be representing some 150 science fairs affiliated with the National Science Fair and will be selected from among the high school sophomore and junior boys exhibiting outstanding projects at the fairs.

## Pepperrell AFB To Phase Out

The Air Force plans to phase out operations at Pepperrell Air Force Base, St. John's, Newfoundland, and return it to caretaker status beginning this summer. The Air Defense Command, which operates the base, says it may take as long as two years to shift all of Pepperrell's activities to other bases and complete the phaseout.

## Air Force Speeds Housing Construction

The Air Force is accelerating its family-housing construction program, with 70,484 units scheduled over the next two years. Nearly 10,000 of these have already been completed in a program which will cost about $1 billion total.

Bulk of the housing will be used in support of Strategic Air Command alert and dispersal facilities, ballistic- and guided-missile sites and expanded Air Defense facilities.

## First ICBM Squadrons

Two Strategic Air Command intercontinental ballistic missile units were activated in April, at Cook Air Force Base, Cal. The squadrons were assigned to the First Missile Division at Cook. They are the 576th Strategic Missile Squadron (SAC's first operational ICBM squadron) and the 393rd Missile Training Squadron (ICBM) which will serve as the training organization for the 576th and follow-on squadrons.

## *This Month:* Dr. Wernher von Braun

**Director of Development Operations Division ABMA**

MORE THAN that of any other individual, the name of Dr. Wernher von Braun has been identified with man's advances into outer space.

This dynamic 45-year-old engineer spearheaded the development of giant rockets in Germany and the United States. More than any other man, East or West, he has earned the title of "Rocket Master."

He directed 10 years of effort culminating in the successful launching of the German V-2 rocket on October 3, 1942.

He directed the development of the U.S. Army's Redstone, which required three years' work before its first launching August 25, 1953.

He has had technical supervision over the development of the Jupiter intermediate-range ballistic missile, a 1,500-mile weapons system, initiated in November, 1955.

He exercised technical supervision over the launching of the Free World's first earth satellite, Explorer I, January 31, 1958.

Already an historic figure in the crowded 20th Century, Dr. von Braun is a man in a hurry, a man of many interests—some unrelated to his legendary engineering accomplishments. He is an excellent public speaker, a colorful writer; husband; father of two daughters; astronomer, flier, skin diver, hunter, philosopher, motion picture consultant, engineer and manager.

Broad-shouldered, sturdily built, he stands 5 feet, 11 inches tall, and weighs 185 pounds—by carefully watching his diet. He moves quickly, talks fervently, laughs often and heartily. He is at once the visionary with fertile, limitless imagination, and down-to-earth industrial director. He is a complex personality with a single purpose—to explore the universe.

The son of Baron Magnus von Braun (who recently celebrated his 80th birthday in Germany), he has an older brother, Sigismund, counselor to the German Embassy in London, and a younger brother, Magnus, associated with missile work in the Chrysler Corporation.

Dr. von Braun's mother, a devoted amateur astronomer, gave her son a telescope on his 15th birthday, fostering his interest in the heavens.

In the Spring of 1930 he joined a group of experimenters working under Professor Hermann Oberth, known as the "father of modern rocketry." At the time von Braun was an engineering student in Berlin's Institute of Technology. That Fall the Oberth group founded the "Raketenflugplatz," sponsored by the Society for Space Travel.

Dr. von Braun devoted all his spare time to the Space Travel Society; he cut lectures to carry on tests and experiments. He was assistant, designer, theoretician. Out of these efforts, he hoped, might come the means by which men could probe the mysteries

of outer space. He is still caught up with beauty of space—it is orderly and predictable.

"Everything in space obeys the laws of physics," he commented. "Why shouldn't man explore it—he belongs wherever he wants to go."

Dr. von Braun was only 20 when he joined the German Army Weapons Department as assistant to then Captain Walter Dornberger, who later, as General Dornberger, supervised the work on the V-2.

When the German Army accepted Dornberger's proposals for large-scale development work in the rocket field, Von Braun suggested a likely location. He had been searching for a site and found Peenemuende while spending Christmas holidays in the vicinity in 1935.

He drew up plans in 1939 for a rocket-powered interceptor plane capable of reaching 35,000-ft. altitude in 60 seconds. It was to be launched vertically and controlled remotely until it reached the level of attacking bombers. Then the human pilot would take over. Air Ministry skeptics rejected the proposal in the fateful Autumn of 1941, convinced that their propeller-driven fighter planes would keep an enemy at bay. Allied airpower proved their mistake.

So Von Braun plunged into the V-2 project with the same intensity and vigor which are the hallmarks of his approach to any problem. General Dornberger, in his book titled "V-2," comments upon the energy and shrewdness with which this "tall, fair young student with broad massive chin and astonishing theoretical knowledge" grasped the enormous problems confronting the rocket builders.

While it may seem crude in comparison with today's guided missiles, the V-2 opened new pages in military and technological history. The war for which it was designed, however, was nearing its inevitable conclusion. Deciding to turn to the West as Germany collapsed, Dr. von Braun and about 125 of his Peenemuende colleagues entered the United States in 1945 with U.S. Army contracts.

The Von Brauns occupy a modest frame, ranch house in Huntsville. One daughter, Iris Careen, is nine years old and Margrit Cecil is six. Their father has fought a losing battle to shield them from the glare of publicity which surrounds his work.

Recognition has been showered on him within the last year. He insists upon sharing the plaudits with his colleagues, most of whom saw the Huntsville, Ala., Chamber of Commerce hand him a plaque as 1957 closed which honored him as the outstanding citizen of the community. His concept of missile development management was aptly stated in an article he published in MISSILES AND ROCKETS magazine:

"The job can only be done by a smoothly working team," he wrote. He emphasized the importance of these requisites: a sense of belonging, elements of spontaneity and group achievement, a healthy working climate, slow and organic team growth. He listed three indispensables for a successful guided missile team:

*Maximum delegation of authority.*

*An efficient and continuous system of communications from top to bottom, and vice versa.*

*Loyalty, honesty and justice.*

"The missile field," he observed, "ex-

tending as it does into technical areas as far apart as fuel chemistry and ultrahigh-frequency radio, stress analysis and supersonic aerodynamics, materials research and gyroscopes, pure mathematics and shop management, cannot possibly be encompassed by a single brain. As in baseball, good players are needed but it is the quality of the teamwork among these players which decides whether they are big league or bush league."

His ability to write pungent, idiomatic English is but one proof of his Americanization. Getting a ticket for passing a red light in Huntsville was another—like many another driver, he still insists that he never saw it.

Since the launching of Sputnik I, his mail has built up tremendously with requests for public appearances—speeches, TV shows, radio and press interviews. He turns down most of these—he simply does not have the time. But he insists that every letter from young rocket enthusiasts who seek guidance must be answered.

Dr. von Braun's personal philosophy is that of a hardheaded but devout realist who believes that the Technological Revolution which the world is experiencing has freed mankind from the yoke of heavy physical labor and has brought with it new dangers.

"If the world's ethical standards fail to keep pace with the Technological Revolution," he has warned, "we will all perish. On the other hand, the tools of war can serve the interests of peace. Any ballistic missile capable of carrying a nuclear bomb over intercontinental range can be modified to carry a few instruments to the moon. The question of which of the two loads will ultimately be placed in the nose of a missile is not in the hands of the engineer or scientist who builds the rocket. It is solely dependent on what ethical standards will prevail in the world in time of crisis."

Dr. von Braun regards ethics and technology as sisters—technology controlling the forces of nature around us, ethics controlling the forces within us.

"Only with God reinstated in the heart of the world will He furnish mankind with ethical guidance through the dangers and pitfalls of the Technological Revolution," he concludes. "Liberation through technology will enable man to devote more time to think and dream. It will raise all civilizations to levels never before attained."

Giant military rockets are themselves the means of space exploration. But Dr. von Braun is thinking beyond them, to the era of earth-circling satellites, space platforms and vehicles which will transport human crews into the farthest reaches of the universe.

# Professional Services

This is an exclusive feature to aid the services in obtaining highly skilled personnel, GS-9 rating and above. Vacancies shown are official releases from the office concerned. Apply direct to the installation where the vacancy exists. For information about other jobs visit or write the nearest military installation.

## VACANCY LIST

**Headquarters, Navy Department**
**Employment Section, Main Navy Building**
**Washington 25, D.C.**

ENGINEERS

Aeronautical GS-11
Aeronautical GS-12
Aeronautical GS-9 to 12
Aeronautical GS-11 or 12
Aeronautical Development Control GS-12
Aircraft Engine Inspector GS-13
Aircraft Inspector (Electronics) GS-13
Bomb Design GS-12
Electronic GS-12
Electronic GS-11 or 12
General Ordnance Design GS-12
Industrial GS-12
Marine GS-11
Ordnance GS-11
Power Plant Development GS-9 to 12
Structural GS-11
Structural GS-9
Contract Specialist GS-9
Digital Computer Systems Specialist GS-9 or 11
Librarian (Cataloging) GS-9
Mathematical Statistician GS-14
Personnel Accounting Assistant (Supervisory) GS-9

POSITIONS REQUIRING PERMANENT CIVIL SERVICE STATUS

Aircraft Engine Inspector GS-13
Civil (Soil Mech. & Pav.) GS-12
Construction Management GS-11 or 12
Electronics (Instrumentation) GS-12
Electronics GS-14
General GS-12
Ordnance GS-12
Accountant GS-12
Accountant (Supervisory) GS-14
Budget Analyst (Male) GS-9
Contract Specialist GS-12
Digital Computer Systems Operator (Supervisory) GS-9
Digital Computer Systems Specialist GS-12
Librarian (Administration) GS-13
Management Analysis Officer (Supervisory) GS-13
Radio-TV Script Writer GS-9
Tab. Project Planner (Male) GS-11

**PRNC, Administration Building**
**U.S. Naval Gun Factory,**
**Washington 25, D.C.**

Aeronautical Research Engineer (Structures) GS-13
Auditors GS-9
Electronics Engineers GS-12, 13
General Engineer GS-12

**U.S. Naval Proving Ground**
**Dahlgren, Virginia**

Engineer, Electrical GS-9, 11
Engineer, Electronic GS-9, 11
Engineer, General GS-9, 11, 12
Engineer, Mechanical GS-9, 11
Engineer, Ordnance GS-9, 11, 12, 13
Mathematician GS-9, 11
Officer, Information GS-11
Physicist GS-9, 11, 12
Scientist, Electronic GS-9, 11
Statistician, Mathematical GS-11, 12

**Commanding Officer**
**U.S. Naval Aviation Ordnance Test Station**
**Chincoteague, Virginia**

Engineer, Electrical GS-9 to 11
Engineer, Electronic GS-9 to 11
Engineer, Mechanical GS-9 to 11
Engineer, Ordnance GS-9 to 11
Mathematician GS-12 or 13

**Industrial Relations Officer**
**U.S. Naval Avionics Facility**
**Indianapolis 18, Indiana**

Electronic Engineer GS-9, 11
Electrical Engineer GS-9, 11
Electronic Scientist (Instrumentation) GS-9, 11
Fire Control Design Engineer GS-9, 11
Mechanical Engineer GS-9, 11
Physicist GS-9, 11

**Navy Overseas Employment**
**U.S. Naval Gun Factory**
**Washington 25, D.C.**

Supervisory Accountant, Argentia, Newfoundland GS-11, *$533
Personnel Specialist, Keflavik, Iceland GS-12, *$631
Electrical Engineer, Guantanamo Bay, Cuba GS-9, *$453
*Plus Quarters
**Plus Quarters Allowance

**2nd Coast Guard District**
**St. Louis, Missouri**

Electronics Engineer (Radio) GS-9

**3rd Coast Guard District**
**New York, New York**

Civil Engineer GS-11
Mechanical Engineer GS-9

**5th Coast Guard District**
**Norfolk, Virginia**

Electrical Engineer GS-11
Electronics Engineer (Radio) GS-9
Civil Engineer GS-9

**7th Coast Guard District**
**Miami, Florida**

Electrical Engineer GS-11
Civil Engineer GS-11

**9th Coast Guard District**
**Cleveland, Ohio**

Electrical Engineer GS-9

**11th Coast Guard District**
**Long Beach, California**

Civil Engineer GS-11

**14th Coast Guard District**
**Honolulu, T.H.**

Civil Engineer GS-9

**17th Coast Guard District**
**Juneau, Alaska**

Marine Engineer GS-11

**Washington Radio Station**
**Alexandria, Virginia**

Electronics Engineer (Radio) GS-9
Maintenance Engineer GS-9

**U.S. Coast Guard Headquarters**
**Washington, D.C.**

Electronic Engineer (Radio) GS-13
Electrical Engineer GS-12
Electrical Engineer GS-11
Engineering Designer (Ship Construction) GS-11
Structural Engineer GS-9
Engineering Designer (Electrical) GS-9

**U.S. Army Signal Intelligence Agency**
**Arlington Hall Station**
**Arlington 12, Virginia**

SUP Military Intelligence Research Specialist (Electronics) GS-13
Military Intelligence Research Specialist (Tel) GS-9
Translator GS-9

**Rome Air Force Depot**
**Headquarters**
**Griffiss Air Force Base, New York**

Geodesist GS-9
Electronic Engineer (General) (3) GS-11
Electrical Engineer GS-11
Geodesist GS-11
Attorney Advisor GS-11
Electronic Scientist GS-11
Photogrammetric Engineer GS-11
Electronic Engineer GS-13

**Civilian Personnel Office**
**Aberdeen Proving Ground, Maryland**

Tabulating Equipment Operation Supervisor GS-11

*Clear delineation of organizational lines and procedures should be observed scrupulously in the normal course of events. But exceptions sometimes require heroic measures which the organization* per se *cannot be expected to supply in a timely manner. Then we must practice . . .*

# Management By Exclusion

**by Maj. Gen. William M. Creasy**
*Chief Chemical Officer, U.S. Army*

*and*

**Nathan Birnbaum**
*Chairman, Dept. of Chemistry, City College of New York*

RECENTLY in reviewing Army Chemical Corps operations during the past 10 years, we were impressed by the frequency with which we have resorted to "management by exclusion." This term is one of our own devising and by it we mean directing and authorizing an *ad hoc* group or individual to accomplish a specific task, a group which is at one and the same time *supra* and *intra* as far as the basic organization is concerned.

At first glance an action of this kind would appear to be contrary to sound organizational and managerial precepts. We have been taught repeatedly that the organization must not be breached; that the formation of splinter groups must inevitably weaken the basic structure and lead to overlap of functions and general inefficiency. We would not argue against this as far as normal operations are concerned.

Actually we are convinced that such action should be considered as consistent with the best management principles, *provided* that the circumstances warrant it; that the dangers are recognized, and guarded against; and that one reverts to the basic organization as soon as the special mission has been accomplished.

In view of the fact that such management is widely practiced without a clear delineation of criteria, principles and guidelines, we thought it might be of value to put down what we have learned (in many cases the hard way) about management by exclusion.

What are the circumstances which compel us to resort to this special procedure in order to accomplish an objective? Remember that the organization is a busy one and that the day-to-day and week-to-week requirements must be met and the work accomplished. Now if there is superimposed upon this organization a new requirement, one or a combination of the following will compel recourse to the mechanism of management by exclusion. We must emphasize that this should always be considered a temporary expedient and that return to the basic organization, modified if necessary, must be effected as soon as practicable.

There may well be others, but in our minds these five items—technical requirements, exigency, magnitude, priority and objectivity—are those of major importance in this consideration.

**Technical Requirements:** Frequently a task will require technical knowledge and skills which may be spread so thinly throughout the organization that they could not be applied effectively for the best results. We have seen this happen when a company, interested in diversification, decides to develop and market an entirely new product. In the military we are continuously faced with such a situation, since we must apply the latest technical and scientific discoveries to improving our offensive and defensive weapons systems. (The military application of atomic energy is an excellent example of this and will be discussed in some detail later.) In such cases it becomes necessary to concentrate the available experts in a special office or group, leaving sufficient capability throughout to carry on other activities. Here is where flexibility comes in: the organizational structure must be able to provide for such contingencies and still operate effectively. In some circumstances, it becomes necessary to supplement the local talent by bringing in outside experts, but these should be in addition to, and not in place of, people from within the organization. The core of the special group must be completely familiar with the activities and capabilities of the enterprise so that they can be best used to accomplish the special mission.

**Exigency:** The time element involved may be such as to preclude accomplishment of an assignment by the basic organization without adverse effects on its normal activities. In the Army Chemical Corps this is frequently imposed by higher authority and may range from studies on budget and personnel problems to accelerated development of a special weapon or defensive item. However, this urgency may also be generated by a discovery or a breakthrough within the operating agencies themselves. In any event, since these are usually short-term affairs, it is possible to accomplish them without lengthy departure from basic procedures.

**Magnitude:** The new requirement may be of such size and scope that the existing structure could not accomplish it without serious dislocation and imbalance. At first glance this may appear contrary to the principle that organization planning and change must be continuous and dynamic. However, this must be evolutionary rather than revolutionary, and no one, we are sure, would recommend an order-of-magnitude change by means of the earthquake approach. Much more sensible is the treatment of this new requirement by a group with the specific skills required. If it is of a temporary nature, then they accomplish it to completion; if permanent, they carry it to where it can be effectively incorporated into the basic organization.

**Priority:** The inherent importance of the task may be such that exceptional measures are required to assure an optimum and timely solution. Frequently, in industry, a circumstance arises where the very existence of a concern depends upon meeting a competitor's development of a dramatic new item. In the military, the national security may very well rest upon the ability to develop a novel idea, produce a weapon of unique qualities or fashion a defense against a new weapons system. It would be folly for the business concern or the military not to devote special efforts to meet the threat in prospect. Of course, one may say that the organization, particularly in the military, should be flexible enough to take care of such situations. Ideally this is true, but while we strive to attain the ideal, we must fallibly fall short. And so we must resort to special

methods which will assure accomplishment of the objective and at the same time retain the effectiveness of the basic organization.

**Objectivity:** All organizations, whether academic, industrial or military, are faced with the problem of the inbred viewpoint and the subjective approach. The "not-invented-here" attitude can be a real obstacle to the development of a new and novel product or technique, and every effort must be made to foster objectivity and to bring an external viewpoint to bear on a task of unusual importance. Management by exclusion is one way to accomplish this. The very act of setting up a special group has the psychological effect on the people concerned of emphasizing the unusual approach. At the same time it will stimulate the normal organization and encourage its members to surmount the inertia to which we humans are so often subject.

And here we must introduce a strong note of caution. The decision to deviate from the normal organizational procedure should never be lightly made, for unless it is based upon substantive facts it can do more harm than good. It can be the easy way and the wrong way to dispose of, without solving, a difficult problem, and the hazards inherent in such deviation must be carefully weighed. To put it bluntly:

## "Make Haste Slowly!"

The hazards fall naturally into two categories: those which affect the basic organizational structure and the morale of the personnel comprising it; and those which are adverse to the special group. Both effects will, of course, be detrimental to the accomplishment of the special task, and the former may seriously weaken the organization itself.

First among the innate risks is damage to the basic organization, both in a material sense and in a very real psychological one. The extraction of capable people from divisions and branches will reduce the capability of those elements and create lowered effectiveness and morale among those left behind. Great care must be exercised to assure that sufficient resources are available to carry out the assigned functions. When this cannot be accomplished, it may be necessary to defer or eliminate borderline activities, or to transfer them elsewhere. In some cases, a general deceleration of routine actions may be preferable. In any event, it should not be difficult to provide for a functional level which will assure continued overall productivity.

The psychological problem is the more difficult one to resolve, since this is emotional and subjective and not readily amenable to reason. It is here that the management tool of communication will be of major importance. Personnel throughout the organization must be fully informed of the new requirement and of the possible courses of action to meet it. Analysis of the effect on the organization should be made and fully disclosed; concern for the problems created should be freely expressed and confidence shown in the ability of the people to solve them. Since good communication must be a two-way street, suggestions and comments should be solicited from the people involved and given careful consideration. In fact, if the preliminaries are handled properly, the final plan for accomplishment of the new requirement will be one which has been mutually devised rather than arbitrarily imposed, and will undoubtedly be a better plan than one thought up by the boss alone. If this is done, then the next problem facing us—the vital one of assuring organizational support for this special effort—is solved.

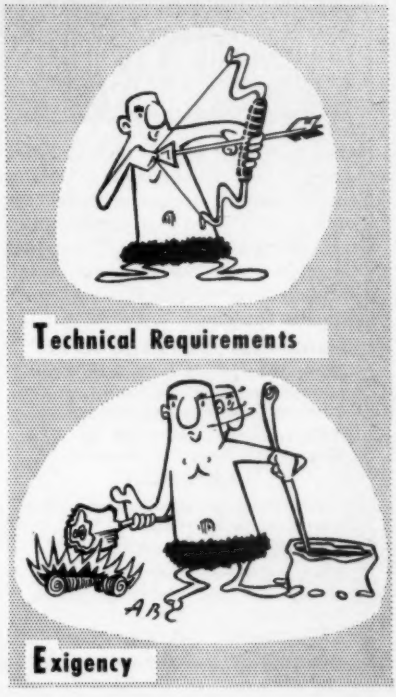
Basic to the application of management by exclusion is the complete utilization by the task group of the resources of the organization. Here the personality and attitude of the personnel of the group are critical, and a good balance must be struck between the demands of the special task and the requirements of normal operation. Certainly we want aggressive, dynamic action, but this must be reasonably requested and sensibly carried out. If possible, it is advisable to select people who are well known and highly regarded within the organization so that there is an actual identification of all with the special group. This will do much to obviate the resentment which might very well be engendered and to maintain the *amour propre* so valuable to coordinated effort.

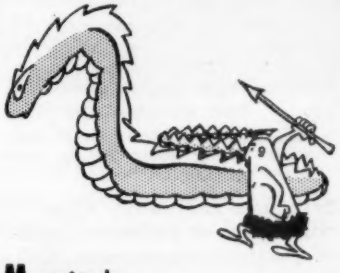
Lastly among the precautions, there must be a very clear delineation of the task to be performed and specific enunciation of the authority involved, with the time element indicated. That the personnel selected must have competence, stability and maturity is axiomatic. And equally important is to impress on the people involved the importance of the assignment and the requirement that all their efforts must be directed to its accomplishment.

## Examples

Now for some examples—case histories, if you will—of management by exclusion. We believe it will be apparent that in some cases all, and in others some, of the circumstances and criteria presented above existed. But in all cases the job could best be accomplished by this procedure.

In 1949, the headquarters of the




## HOW BORG EQUIPMENT DIVISION CAN HELP YOU

**Our business is helping to solve design and production problems in the use of components for the highly specialized electronics industry. Borg's background provides the experience necessary to design and produce various types of components for you . . .**

**MICROPOT* POTENTIOMETERS**

Borg Micropots offer a wide range of high-precision, single-turn, multi-turn and trimming potentiometers.

**Registered trademark of The George W. Borg Corporation.*

**MICRODIALS**

Direct Reading Microdials and Concentric Scale Microdials.

**INSTRUMENT MOTORS**

Rugged, dependable Borg-Motors are designed for quality instrument applications.

**AIRCRAFT INSTRUMENTS**

Instruments for commercial and military aircraft.

**FREQUENCY STANDARDS**

To meet your requirements in Frequency Standards for military or industrial applications.

**TEST EQUIPMENT FOR AUTOMATION**

Invaluable experience with automatic testing equipment is yours when you call on Borg.

**Save time and money when faced with design or production problems of electronic components. Call on Borg. Let us send you the name of your nearest Borg "Tech-Rep" and a copy of catalog BED-A90 today.**

## OTHER BORG DIVISIONS

**The George W. Borg Corporation is comprised of three divisions . . . the Borg Equipment Division at Janesville, Wisconsin, the Borg Fabrics Division at Delavan, Wisconsin which manufactures the fashionable "Borgana" fabric for coats and jackets and the Borg Products Division at Delavan, Wisconsin, leading manufacturer of automotive clocks.**


**BORG EQUIPMENT DIVISION**
THE GEORGE W. BORG CORPORATION
JANESVILLE, WISCONSIN

For more facts request No. 14 on reply card.


Army Chemical Corps Research and Engineering Division, an element of the Office of the Chief Chemical Officer, was physically located at the Army Chemical Center, Maryland. This organization, with its operating elements, was responsible for all research and development in chemical and biological warfare and consisted of a staff of more than 100 people and two large operating installations—Technical Command at the Army Chemical Center, concerned with chemical warfare, and Camp Detrick at Frederick, Maryland, engaged in biological research. Since this case history deals entirely with the headquarters, any further mention of the operating elements will be omitted here.

The headquarters consisted of the executive office, a plans and evaluation office, a research branch, a development branch, and an engineering branch. This headquarters was responsible for staff supervision of the operating agencies and performed essentially the functions of a modified line-and-staff organization. Total personnel in all elements amounted to more than 4000 and the total yearly budget was approximately $8 million.

In 1949, a new responsibility—that of research and development for radiological warfare—was assigned to the Research and Engineering Division. This involved research into the characteristics and effects of radioactive agents; investigation of problems of handling, decontaminating and detecting; development of protective devices; participation in atomic-weapons tests in the Pacific; and coordination with the Navy, Air Force and the Atomic Energy Commission.

All of the criteria for management by exclusion were clearly evident. The magnitude of the job was obvious. It was entirely possible that a new weapons system, with unique qualities and potentialities, could be developed. In particular, determination of the hazard and development of defensive measures were urgently needed. Priority and urgency were equally obvious. International relations were anything but harmonious and it appeared imperative for the national security that we establish the feasibility of this new form of warfare without delay. Technical requirements were unusually severe and the number of people with adequate knowledge of atomic energy and nuclear reactions was woefully small. At the same time the demands in the chemical and biological warfare areas were compelling and no diminution there could be countenanced. After a rapid but thorough analysis of requirements and resources, it was decided to establish a Special Projects Office with complete staff responsibilities in the radiological warfare field. It was headed by a man with broad technical and administrative experience, highly regarded as a person, objective and considerate as an administrator. To his office was assigned a small, select group with competence in nuclear physics, engineering, atomic weapons phenomenology and scientific research. A direct channel to the front office was established, and steps were taken to assure complete support of this new office by the entire organization.

The activities of the group were eminently successful and our requirements were met effectively and in a timely manner. We were able in a short period of time, without undue adverse effects on other functions, to define the detailed problem, organize the operating elements and direct and supervise the research and development program. Close coordination was established with the Navy and the Air Force, and a good working relationship initiated with the Atomic Energy Commission.

In our minds from the very beginning was the requirement that the responsibilities and functions of this group be integrated into the basic organization as soon as possible. As a result, we were able to effect a smooth transfer over a reasonable period of time, and radiological warfare is now an integral part of the Chemical Warfare Laboratories.

Another example of greater magnitude and urgency occurred in the construction of the plants for the manufacture of nerve gas. You will recall the tension which existed before and during the Korean conflict. In order to be prepared for the extreme eventuality of general warfare, we had to establish a capability to counter the use of toxic agents against us. We had no stocks of this most potent agent nor did we have the manufacturing facilities for its production, and it was immediately apparent that a gigantic effort would be required to overcome this deficiency. General McAuliffe, at that time the Chief Chemical Officer, decided that the best way to accomplish this was through the establishment of a Special Assistant to himself with complete responsibility for the construction and testing of the plants required.

The problem was made unusually complex by a number of factors—the size itself was of a major order of magnitude; there was insufficient time to determine the best method of manufacture through orderly development from the process-development stage to the pilot plant, thence to the semi-works stage and finally to the full-scale plant (actually the semiworks stage was omitted entirely and the final steps of

process development and pilot-plant work went on concurrently with the construction of the full-scale plant); the nature of the chemicals created almost insurmountable byproduct problems and required the use of strategic metals in short supply, with the highest priority required to obtain them; time was of the utmost importance since militarily we might be in a crucial situation if an emergency arose.

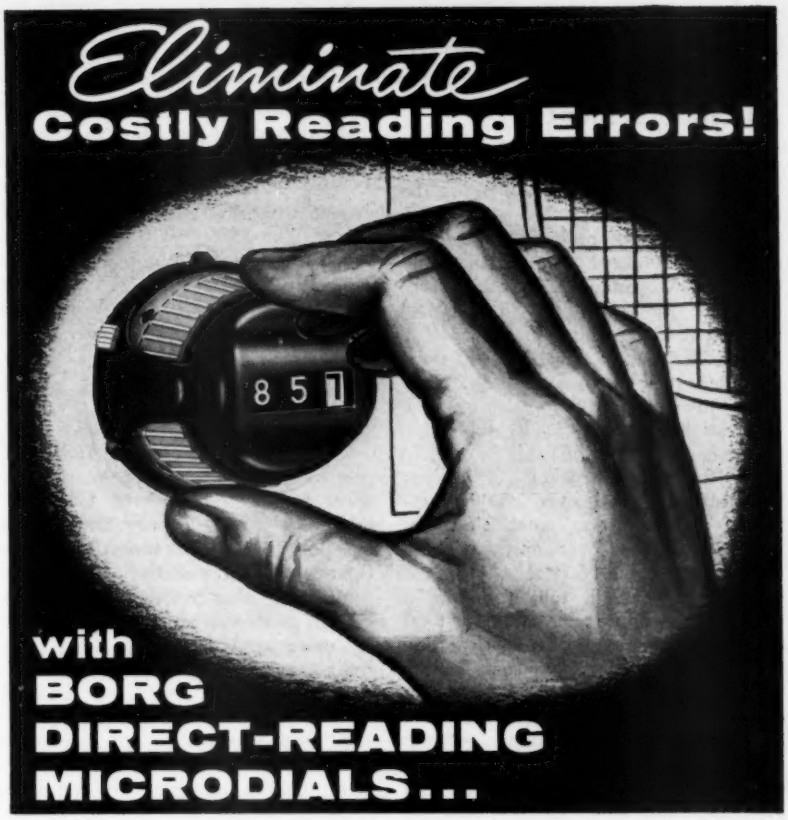
Not only were these major difficulties inherent in the problem, but circumstances combined to produce other complicating factors. First, it was imperative that the Special Assistant and his staff have a high order of administrative ability, advanced engineering and technical knowledge and exceptional drive and determination. It would have been preferable to select these individuals from the operating elements whose support was essential to the mission, but a critical personnel shortage there made this impossible. So it was necessary to go to sources outside these elements for the people with the necessary experience and ability.

Second, effective utilization of the resources of these operating elements was made difficult by the fact that there were two separate and distinct elements involved, with different missions, objectives and philosophies—one concerned with research, development and engineering; the other with manufacturing, procurement, storage and distribution. Compare this with the case of radiological warfare, where the organization was small, tightly knit and concerned only with research and development.

Third, because of the broad nature of the task, the Special Assistant was necessarily set up above both these elements and not within either one. In other words, there was the *supra* mentioned at the outset but the *intra* was missing, and there could be no easy identification of either of the operating elements with the Special Assistant. All of these factors were fully recognized and steps were taken early, and successfully, to overcome them through staff coordination and working relationships.

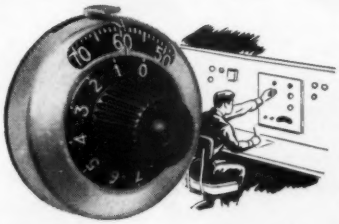
Working groups were set up in the operating elements to assist the Special Assistant with planning, expediting and managing the plant through the construction and initial testing phase. These groups assured coordination with Materiel Command and Research and Engineering Command so that maximum assistance could be rendered and eventual transfer of responsibilities to these commands could be made smoothly and efficiently. That this team

*(Continued on page 32)*


Large, clear numbers are easily and accurately viewed through the curved, one-piece window of Borg Direct-Reading Microdials. The in-line digital presentation practically eliminates reading and setting errors . . . especially under the difficult conditions of forced fast reading and setting. Human engineering studies have determined that the greatest accuracy of perception of precise numerical values is provided by an in-line digital presentation. Borg Microdials are designed to take maximum advantage of this fact. Available in 3, 4 and 5 digit models.

**CONCENTRIC SCALE MICRODIALS**



Borg Concentric Scale MICRODIALS indicate the position of any multi-turn device of 10 turns or less.

Borg Concentric Scale MICRODIALS are precision dials with an indexed accuracy of one part in 1,000. They indicate the position of any multi-turn device of 10 turns or less. Concentric scales indicate full turns and increments. Finger-tip brake retains any setting. Knob fastens directly to shaft . . . no backlash. Accurate . . . easy to install.

**Write For Complete Data On All Borg Microdials**
**Ask For Catalog BED-A90**

**BORG EQUIPMENT DIVISION**
**THE GEORGE W. BORG CORPORATION**
JANESVILLE, WISCONSIN

ELECTRONIC – MECHANICAL BORG EQUIPMENT
Built by Borg
MOTORS
MICROPOTS
MICRODIALS

For more facts request No. 2 on reply card.

## AF Management Problems Discussed

Vast missile-age problems facing the Air Force and steps being taken to solve them were outlined to the Institute of Radio Engineers by Brig. Gen. Lee W. Fulton, Director of Procurement for Air Research and Development Command.

The Air Force, said Fulton, must manage technological resources in order to get jobs done well in the shortest time and at the least possible expense. In doing this, AF must deal with 16 prime contractors, 200 major subcontractors and over 25,000 suppliers and vendors, comprising the largest program "ever undertaken in the history of the Nation."

Involving over a billion dollars a year for the past two years, the total cost comes to about $3 million a day for the period. However, said Fulton, "these expenditures will give us an integrated overall program leading to and including operational weapon systems."

Air Force management, Fulton told IRE, has done much to cut down the cost. Using the dual subsystem base, AF managed to use Atlas ICBM developments to get the Titan at only 10% additional cost. Also, he said, the Thor IRBM borrowed from the Atlas booster package, yielding additional savings.

Through centralized, flexible management, said Fulton, Air Force is able continuously to feel the "program pulse" on any project, bringing savings both in time and money.

## AF Changing Source Selection Procedures

About 50 percent of the Air Force's procurement dollars are now being spent for electronics, Brig. Gen. Beverly H. Warren, Deputy Director for Weapon Systems at the Air Materiel Command, said recently.

Warning that reliability and integration problems are forcing the turn to more and more of the single weapon-system type contracts, Gen. Warren said: "However, we are still, and will continue for some time, buying large quantities of electronic equipment directly from manufacturers. But here again the pattern is changing toward the systems concept and away from past methods of purchasing individual black boxes performing a single function. Where the equipment forms a part of a weapon, it is now identified as a subsystem.

"In developing our source selection procedures, we are looking toward increased use of project teams, which will utilize capability and know-how of not only the buying components of AMC but the engineering support of ARDC and the Development Centers. We do not intend to limit our thoughts only to a small group of possible primes, but continue to consider those other contractors who may be able to make a great contribution to the success of our programs, through participation as subcontractors."

## Contractor Relations Attacked

David Fromson of Greer Hydraulics has urged action by Government and industry to resolve what he called costly "problems and delays arising out of prime-subcontractor relations."

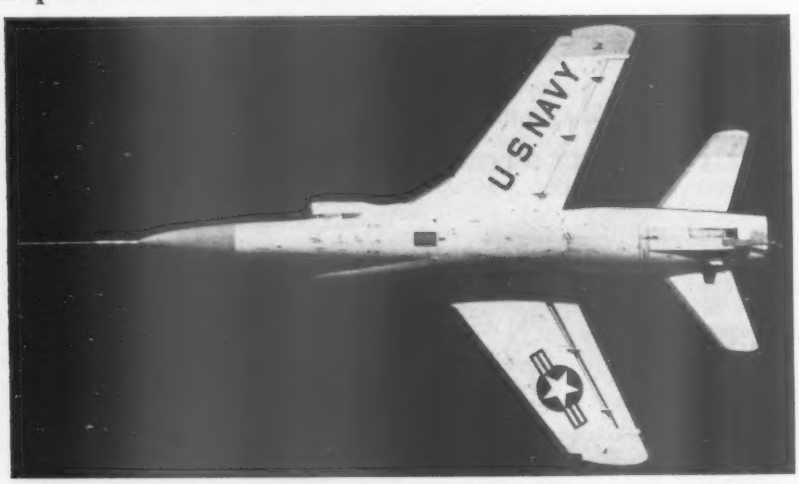
Fromson, chairman of the Special Tasks Committee of the National Security Industrial Association, was addressing a joint NSIA Procurement Advisory Committee-Maintenance Advisory Committee meeting with Air Force procurement personnel in Dayton, Ohio.

He said the subcontractor's roles have been emphasized under the "weapons system concept." He urged the Government to revise and unify the various Services' policies and attitudes regarding control over subcontractors in the areas of cost control, termination procedures, change orders, dispute situations and delays.

Among the costly and unnecessary delays in administration of defense contracts, Fromson cited:

1. Administrative procedures attending pricing and provisioning of tools and spares.
2. Inability of manufacturers to secure prompt confirmation of specification changes.
3. Auditor's report sent through delaying channels instead of direct to contracting officer.
4. Uncertainty resulting from unsettled or lapsed fiscal regulations of the Government.
5. Administrative difficulties attending the effective utilization of Government-furnished facilities; absence of time specified within which contracting officer approves subcontract.
6. Inadequate time to submit quotations due to delays in releasing "small business" proposal forms by local procuring agencies.

## Japanese Pick Grumman




The Grumman F11F-1F Super Tiger jet fighter has been selected by the Japanese Defense Agency to become a key part of their Air Self-Defense Force.

The selection of the Super Tiger in an evaluation contest between many U.S. fighters ends a two-year quest for a supersonic jet interceptor for Japan. The aircraft, powered by a General Electric J79 turbojet engine, is scheduled for production in 1959. Three hundred aircraft will be produced, most of them in Japan, under a joint plan between the U.S. and Japanese Governments before the final delivery date of year-end 1962.

Primary stated reasons for selection of the Grumman aircraft were "its outstanding short field capability, ease of pilot transitional training and extreme versatility."

## New Company In Missile Field

The Hydrodyne Corporation has been formed to manufacture various fluid control products for the aircraft and missile industries. Announcement was made jointly by J. H. Overholser, president (formerly with Pacific Div., Bendix Aviation Corp.), and Robert T. Skinner, executive vice president (owner of the Skinner Seal Co.).

The corporation has acquired a new 18,000-sq.-ft. plant in North Hollywood, Calif. According to Overholser, Hydrodyne is "particularly interested in high- and low-temperature and also high-pressure problems and products involving exotic fuels, including cryogenics, atomic energy and other difficult to control fluids and gases."

## Douglas Reveals New Transport

It may be possible to airlift all the Nation's ballistic missiles in the near future. (Chief among those which are not at present is the Air Force Atlas ICBM.)

A new version of the Douglas C-133 turboprop transport—the C-133B—was revealed by Donald W. Douglas, Jr., at a recent stockholders meeting. Although no details of the "B" version were released other than that it is a "new and improved version," it is presumed the new model is a modified C-133 capable of carrying any of the Nation's ballistic missiles. Air Force has already ordered 15 of them.

## Army Wants New Helicopter

Army is looking for improved light and medium helicopters, said Brig. Gen. Ernest F. Esterbrook, director of Army Aviation, recently.

One of the new requirements is a rear-loading capability to facilitate handling of supplies and airlifting of such items as guided missiles. Stating a new three-ton helicopter is under construction, Esterbrook predicted tactical missiles of the Army will all be airlifted within combat zones, added he forsees a marriage of tactical missiles and Army airlift, with the lift capability of the aircraft improving and missiles growing lighter in weight.

## Pilot Tug Test Successful

Air Logistics Corporation's new high-speed jet aircraft moving and positioning vehicle, the "Pilot Tug," recently underwent tests, termed "successful," at Castle Air Force Base, Calif.

Utilizing the principle of friction drive, the driving wheels of the vehicle are hydraulically lifted and locked to the aircraft's main landing wheels. It becomes an integral source of power over which the pilot has full command, also supplies electrical and hydraulic power while in motion, a pilot-operator intercom, two-way radio communication and air supply for jet engine starting. The Pilot Tug is designed to move heavy military jet and turboprop aircraft, such as the 323,000-lb. B-52, at speeds of from 25 to 42 miles per hour, is able to tow without a tow-bar. Air-Log analysts estimate the "Tug" will provide direct cost savings of $100,000 per aircraft annually in fuel and engine-repair expense, in addition to reducing the size requirements of terminal areas.


**Pilot Tug in position to pull a B-52.**

**Fact Sheet on . . .**

## Air Force Weapon Systems Procurement

| Designation | Contractor | Status |
|---|---|---|
| | **Fighter Aircraft** | |
| F-100 | North American Aviation, Inc. | Operational |
| F-101 | McDonnell Aircraft Corp. | Operational |
| F-102 | Convair Division | Operational |
| F-104 | Lockheed Aircraft Corp. | Operational |
| F-105 | Republic Aviation Corp. | In test |
| F-106 | Lockheed | In test |
| F-108 | North American | Development |
| | **Bomber Aircraft** | |
| B-52 | Boeing Aircraft Co. | Operational |
| B-58 | Convair | In test |
| B-70 | North American | Development |
| Nuclear bomber | All details classified | |
| | **Air Defense & Tactical Missiles** | |
| Mace | Martin Co. | In test |
| Bomarc | Boeing | In test |
| Falcon | Hughes Aircraft Co. | Operational |
| Sidewinder | U.S. Navy | Operational |
| Genie | Douglas | Operational |
| | **Strategic Missiles** | |
| Snark | Northrop Aviation Co. | In production |
| Rascal | Bell Aircraft Co. | In production |
| Thor | Douglas Aircraft Co.* | Development |
| Atlas | Convair* | Development |
| Titan | Martin Co.* | Development |
| Quail | McDonnell | In test |

** In the case of ballistic missiles especially, each major component—airframe, propulsion, guidance, nose cone—is the subject of a direct Air Force contract. The airframe prime contractors indicated also have responsibilities for final assembly, as well as installation, calibration and checkout.*

# Systems . . . Panoramic Approach to Management

*In management, one must concentrate upon the "whole system" to avoid what one management consultant aptly described as "polishing brass on a sinking ship."*

by W. Sidney Taylor

THE BASIC concept of systems engineering is probably best described by a little ode from the Martin Aircraft Systems Engineering Manual:

"Now in building aircraft, remember too!
An integral plan must be carried through:
Lest the weapon prove an unhappy thing
With a jet too strong or a weakly wing,
With a tail too low or a cost too high,
With inadequate radar or fuel supply,
With a bombing load somewhat over-weight,
Or a system, perhaps, going out of date—
Designed too early or built too late!"

Rapid advances in science and technology are tending to preshape not only our personal lives, but our industrial progress and national destiny as well. Atomic power, the jet airplane and the TV set are but a few of many product and weapon systems which are today changing the American way of life and the American standard of living.

The effect of this phenomenon has been an increasing emphasis by top management—not only in business and industry but also in government—to think, plan and manage in terms of major operational "systems."

What do we mean by a "system"? A system, as the writer sees it, is an aggregation of interacting functions or components which have been assembled to achieve a specific objective or effect. In principle, this applies to a product, a weapon, a production line or an administrative process. Each has a purpose for being and each is an aggregation of related components. Inherent in this thinking is the premise that almost everything we do, make, operate or construct involves a system.

A system as such may involve human, mechanical, chemical or structural components. As a composite it may have operational, logistic or combat objectives. Determining precisely what is and what is not a "system" is purely relative. An air base involving 6,000 people and 50 airplanes can be a system. A servo mechanism on one airplane on the same air base can also be a system. It all depends upon the level of management involved and the scope of analysis.

In the past, systems engineering principles have largely been limited in application to the product-design or military-weapon fields. Industrial designers and engineers, particularly in the aircraft field, have leaned heavily upon the systems approach in developing large, complex, interacting operational systems such as are involved in guided missiles, supersonic aircraft or radar networks, etc. However, a gradual transition is now occurring in the management field where the application of operations-research and systems-engineering principles is becoming more and more commonplace.

## Why Systems Engineering?

One of the primary reasons for this transition is the complex and panoramic nature of the action systems inherent in today's age of big business, big industry and big defense. Both weapon and product systems often involve all of the physical and many of the social sciences. As Goode and Machol wrote in their recent book *System Engineering* "There are more of us; we interact with one another more often; and we move with greater speed. We do more things, more kinds of things, and more difficult things." In such a climate, it is no longer sufficient to simply build the better mousetrap. Today's manufacturer or executive must think and plan in terms of an entire mousetrap system.

At the same time, today's operational systems (product, logistic or weapon) introduce new magnitudes of risk. Decision-making, particularly at top management levels, often encounters "the megabuck decision." This expression reflects the risk often involved in the modification of a major operational system. A million dollars (or megabuck) is often committed by the adoption of a single policy, plan, assumption or operational concept. Ford Motors' introduction of the Edsel, for example, was a 250-million-dollar "product system" decision. This is a king-size example. However, many average-size business and industrial enterprises face million-dollar decisions at least once a year. In the military services, the modernization of a bomber command, a naval task force or an airborne Army division may often involve billion-dollar "weapon-system" decisions.

Compounding this problem is the fact that decisions, like equipment, also become obsolete. A system based upon policies, concepts, or planning assumptions appropriate a year ago may be a costly way of doing business today due to technological, economic or legislative changes. The Jones and Lamson adage, "The man who needs a new machine tool is already paying for it," also applies to products, weapons or operational systems.

Expanding this point in a recent ORSA article, Dr. Ellis A. Johnson, Operations Research Office, Johns Hopkins University, pointed out:

> "Up until about 1000 A.D. weapons had a lifetime of about 400 years; from about 1500 A.D. until the beginning of the twentieth century, a lifetime of about 50 years. But today weapons systems have a lifetime of about five years, and tend to be obsolescent by the time the first units come off the production line."

Recognizing this trend towards inherent complexity, risk and obsolescence in large-scale operations, both industry and Government are placing greater emphasis upon the so-called "systems approach."

Systems engineering, similar to operations research, begins with a "whole system" attitude. This requires an ini-

tial determination of the boundaries and objectives of the system itself in broad terms. Once these are defined, then systems engineering is primarily concerned with optimizing operations in terms of the whole system rather than with improving operations within one division or function. However, in order to understand the whole system, study must be made into the various major components, their roles and interactions with one another. For this reason, work at the level of the whole organization or system requires a different attitude on the part of management than work conducted within one segment of the organization.

This attitude has been described in various ways by people from industry or business such as Mel Hurni of General Electric, who says:

> "In GE, there is a growing understanding that the real power of operations research lies not so much in the solution of individual problems as in providing an increasingly clear vision of a business as a whole . . . a basis for understanding by all our managers of their responsibilities within the almost autonomous departments that they run."

John E. Kusik, Vice President, Chesapeake and Ohio Railway Company, puts it thus:

> "Operations research may be defined as analysis of operations for decision making purposes and for designing efficient operating systems. The only element of newness in OR is a systematic search for opportunities for application of scientific techniques developed in the various fields of science. Its greatest contribution to business lies in the emphasis on viewing problems from a company-wide perspective."

OR or systems thinking tends continually to reorient the modern manager towards the fact that he is not only managing men or machines—but more importantly that he is administering a whole operational complex often involving an interacting mixture of people, machines, objectives, human motivations, controls, planning, programming, policies, methods, environments, etc. These include multi-dimensional factors and elements many of which cannot be easily quantified nor structurally portrayed. Once this awareness is achieved, it then becomes apparent that interactions between these various forces require the most skillful type of management analysis.

This has resulted in a multidiscipline approach which was summarized by Professor Russell L. Ackoff, Case Institute of Technology, in a talk recently:

> "Operations research can be characterized very briefly as the scientific investigation of problems involving the management of organized man-machine systems. It should be reemphasized that many of the phases of such problems are investigated by various branches of engineering and science, but it is the whole problem—the problem in all its aspects—that is the subject of operations research. Thus it is for this reason that the industrial engineer sees industrial engineering in OR, the economist sees economics, the statistician sees statistics, the cyberneticist sees cybernetics, and so on. It is all of these things and more. The 'more' arises out of the integration of all of these approaches."

In the weapon-systems area the Air Force, for example, has defined (AFR 5-47) a weapon system thus:

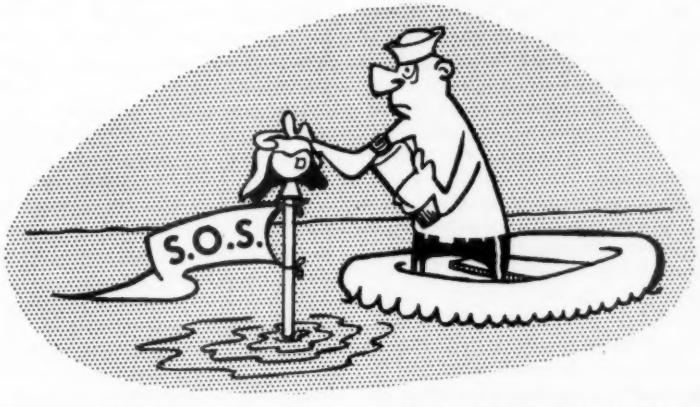
> "A weapon system is composed of equipment, skills, and techniques, the composite of which forms an instrument of combat, usually, but not necessarily, having an air vehicle as its major operational element. The complete weapon system includes all related equipment, materials, services, and personnel required solely for the operation of the air vehicle or other major element of the system, so that the instrument of combat becomes a self-sufficient unit of striking power in its intended operational environment."

In terms of the multibillion-dollar deployment of resources involved in our national defense programs, a weapon-systems concept becomes an important management tool, if not a weapon itself, directed towards insuring optimum distribution of resources and effort. This concept was largely outlined in a statement from the Hoover Commission Task Force on Research and Development in the Federal Government (May 1955):

> "The increasing application of science and technology in the instrumentation of warfare has brought about a major change in the character of weapons. An integration of the operating elements into a 'weapons system' is the growing pattern of weaponry. A single element of the system cannot be developed independent of the others."

In weapon systems, the primary problem is not always technological; in many cases, it is managerial. We may have the people, the skills, the equipment and the know-how. Success may not depend upon resources as such, but rather upon how we utilize and deploy resources. In today's global weaponry race, any single component can become operationally or technologically obsolete overnight

The same problem exists in business and industry. Without proper deployment of resources, it is possible to operate an efficient, yet ineffective, business. Like tactics versus strategy on the battlefield, it is possible to win a battle and thereby lose a war. Some business firms which have emphasized efficiency and economy have nevertheless fallen in the competitive race. This does not mean to encourage slipshod methods, wasteful practices, nor inefficiency. However, it does emphasize the need for concentrating upon the "whole system" to avoid what one management consultant aptly described as "polishing brass on a sinking ship."




Under modern tax laws, for example, some large firms actually seek inefficiency in the form of tax-loss corporations. Uniquely enough, when losses are injected into a large corporate system (under present tax rules), they often improve overall profit effectiveness. The same situation exists on the production line. One OR study, for example, revealed that full utilization of productive capacity actually reduced the profit potential of an industrial firm by $250,000. It is

at this point that we begin to differentiate between the scientific management problems of the late 1920s and the strategic management exemplified by OR and systems-engineering techniques of today.

Advancements in data processing are having the interesting side effect of making managements look at their whole enterprises or businesses, in some cases, for the first time in their existence. Integrated data processing, particularly, is forcing modern managements to think in at least two dimensions: (1) analysis of major functions in a vertical sense, down through various organizational echelons; and (2) analysis of the interactions between major functions—in a horizontal sense—across the board.

This is one of the primary reasons for the expanding role and importance of the computer (analog or digital). Human ability to memorize the numerous elements involved in large-scale business or government operations is no match for a battery of tireless electronic memory devices containing possibly 5,000,000 characters with individual access timed in a matter of milliseconds. This has given rise to one of the most important applications of the computer—its ability to simulate large-scale operations, on paper, from data or information often too voluminous or complex for human comprehension.

This process was summarized in a recent WALL STREET JOURNAL article concerning activities of the RAND Corporation in working for the Air Force.

> "Some of RAND's best brains dwell in a world of pretense—a world of violence in which the casualties are often shocking but so far purely imaginary. They are conducting an endless series of mock air battles by feeding complex data into a huge, flashing analog computer. The object: To discover, by bloodless trial and error, the best combination of men, weapons and tactics to crush an enemy."

However, computers and data processing are only one facet of the total systems problem. As more complete, and current, management information becomes available through integrated data processing, the decision-making process at top management level become more, not less, difficult. The ultimate problem in large management control systems is not one of collection but rather one of interpretation, analysis and synthesis of what the readings on the electronic instrument panels of management really mean. Nobody has yet developed a black box to replace human judgment. Managers still have to manage. The data-processing problem really begins when the final report, electronically prepared and electronically computed, lands on the president's desk. At this point, the role of the modern executive becomes one of a master synthesizer who must recognize and relate all the important elements of an entire operating system —before making megabuck decisions.

## The Challenge To Management

Underlying this situation is the fact that improvements are needed in the techniques for comprehending and managing large-scale man-machine systems. Operations research is one of the most promising developments to date. However, like Alice in Wonderland, modern managements must learn to step through the looking glass of present-day operations into a never-never land of yet unborn, yet unknown, products or weapons. This is not easy. In many areas, 90% of the products or weapons in use today were completely unknown or unborn as recent as the 1930s. Advancements in basic science have opened up the way for complete breakthroughs in applied science or technology. In weapon systems, for example, modern electronics and nucleonics have made the guided missile a wild deuce in the poker deck of airpower. In product systems, automation, new materials and new resources are creating a situation where our ability to produce is rapidly overtaking our ability to manage.

Although we have the energy (atom), and the tools (automation) to usher in an entirely new era, one ingredient is missing. Greater managerial skill and imagination (computers can't do this) are needed to synthesize the nonmechanical, nonmetric aspects of large-scale man-machine systems.

This is indicated by the paradox that our weapon systems may soon take us to the moon, while our abilities in socioeconomic systems have not yet solved such earthly matters as inflation or human unemployment. These challenges plus the growing bigness and complexity in business and governmental operations are ushering in a new era of systems and systems thinking. As part of this process, OR concepts and data processing may soon combine to produce a new and real breakthrough in the art and science of management.

*NOTE: Mr. Taylor is a member of the Systems Analysis Group, Directorate of Personnel Planning, DCS/P, Headquarters United States Air Force. The views and opinions expressed in this article, however, are solely those of the author.*

## Exclusion

*(Continued from page 27)*

effort, headed and directed by the Special Assistant, was successful is attested to by the existence of what we call Site A and Site B, one in Alabama and the other in Colorado, the combination of which provides this Nation with its required capability in one aspect of toxicological warfare.

An interesting application of management by exclusion is the "commander designate," which was used frequently during World War II to prepare the organization required to operate the next base or area to be captured from the enemy. A commander was selected and provided with a small staff which was "peeled off" from the various staff sections of an established headquarters. Stationed at this headquarters and using available resources to the maximum, the "commander designate" was able to make his plans for rapid utilization of the captured territory. A valuable bonus resulted from this procedure; since there was also complete identification of the established headquarters with the new one (their relationship was almost that of parent and child), support of the latter during the critical early stages of occupation was assured. Supplies, equipment and services were freely given to the new headquarters, frequently at the expense of the old, and the time required to attain a self-sufficient status was materially decreased.

At the present time this exclusion principle is being used in connection with the establishment of a four-day high-level orientation course by the Corps. The purpose of this course is to present to senior military and civilian personnel of the Department of Defense and other agencies, current and future capabilities of chemical, biological and radiological (CBR) warfare; to discuss the role of this form of warfare in present and future weapons systems; and to describe the defensive problems of CBR warfare.

Many more examples of this method of operation could easily be cited. Actually we cannot recall a time when we have not had one or more groups operating as a separate entity both within and above the basic organization. And we believe that this is true also in other elements of the Government, in industry and in academic institutions throughout the country. Why such operation has not received more consideration and study we do not know. Or perhaps it has, and has escaped our attention. In any event, this preliminary, and necessarily limited, report may be of some value in an area needing careful thought.

# Stretching the Dollar at Joliet Arsenal

**by Colonel Samuel W. Parnelle, Jr.**

*Commanding Officer, Joliet Arsenal*
*Joilet, Illinois*

JOLIET Arsenal, located southwest of Chicago, in Will County, Illinois, is dispersed over 55 square miles of relatively flat Illinois landscape, functioning under the Ordnance Ammunition Command (OAC) of the Ordnance Corps.

Until the installation of the mechanical and electronic tabulating equipment in 1953, nearly all accounting procedures were on a manual basis.

The manual system had many disadvantages. It required a large staff of skilled employees. Recurring peak loads caused headaches. To cut excessively high operating costs punched-card equipment was installed. The key unit in this group is a Univac 60, punched-card electronic computer.

Sixteen clerks and machine operators (first and second shift) operate and support the machines. They include: one chief of operations; one clerk-general; two section supervisors; one tab project planner; six punch operators; five tabulating equipment operators.

One of the first applications introduced on the tabulating equipment was the labor cost reporting system. The entire operation centers around an employee job card.

Pre-punched cards are periodically distributed to each department. Cost code number, expenditure order number, and hours are hand-inscribed daily, then returned for editing and punching of the written information.

Once proved correct by means of verify punching, the job cards are processed for rates and dollar amounts on the Univac 60.

All detail information is now ready for the processing of daily and month-to-date hourly and amount figures. By sorting and tabulating the summary cards produced from the daily reports, we are able to produce pay period, accrual period, and monthly cost reports by the various cost code and expenditure order number code designations.

Additional codes have been incorporated to produce manpower utilization reports. At this writing labor costs for approximately 4500 employees are reported daily or periodically on employee job cards.

Subsequent to finalizing the methods applicable to Labor Cost Reporting, a Material Cost System has been introduced which allows for the process of combined labor and material costs. The established method is applicable to both ammunition, components and general stores materials. The basic data is obtained by utilizing a synchromatic punched card which is produced on the Accounting Machines located in the Property and Stock Control Branch. Basic data is obtained from Receipt and Issue Documents at the time of posting to the accountable record ledger card. As postings are made to ledger cards, the synchromatic attachment produces a punch card containing required data. Punched cards are then forwarded to EAM Systems Branch for interpretation and tabulation of proof listings. Proof listings are then forwarded to Property Branch for reconciliation to ledger cards. Punch cards are then placed in file until end of month at which time required reports are processed. Subject reports include: average unit price of ammunition and components; stock status; material costs by expenditure and job order; financial inventory balances and labor and material costs.

Following introduction of these operations, a personnel statistics application was begun. Due to the amount and diversity of reports needed by the Civilian Personnel Office, a system of reporting through punched cards was devised. Reports are produced primarily by either a counting sorter, or a tabulator.

Information such as type of personnel action; grade and step; department; date of next trial period appraisal; date of next step increase; job number and family series number; social security number; sex; class of employee (Wage Board or Class Act); etc., can readily lend itself to a multitude of reports at an installation such as ours.

A typical monthly report would be a personnel count of each type of personnel action (promotion, step increase, etc.) processed during the reported month. Another typical report would consist of a listing of all personnel due to receive a step increase in the succeeding month.

Another application recently implemented was the processing of fiscal data utilizing synchromatically produced punch cards for tabulation of fiscal obligations and expenditures as related to budget and programming and accounting, thereby reducing the manual workload in the Budget and Programming Branch and providing a ready reference in determining problem areas in programs and/or funding, allowing for a timely request for proper adjustments thereto.

Most recent addition to the workload is the preparation of civilian payrolls. Some 4500 accounts are processed every two weeks. Of these, Joliet Arsenal accounts for approximately 1500 and OAC 1500, with the remainder covering various arsenals, work and plants satellited on Joliet Arsenal for payroll-preparation purposes, such as Cornhusker Ordnance Plant, Iowa Ordnance Plant, Alabama Ordnance Works, Indiana Arsenal and many other installations within the OAC Headquarters complex.

In addition to processing of payroll, a method for compiling personal services costs for all installations within the OAC complex has been imple-

**Univac 60 computer being prepared for operation by inserting input and output panel board.**

mented, thus allowing for the centralized control of applicable costs and other required statistical data.

These various payrolls are not processed in an identical manner. Within each organization there may be two types of operating personnel—Class Act and Wage Board.

Within Class Act there are small groups such as fire fighters who receive different premium rates than office workers. Within Wage Board there are various shift premiums. Five different satellite payrolls could conceivably receive five different premiums, thereby adding to the complexity of the operation.

Byproducts, such as bond accounting and Government annual and sick leave accounting, are also processed concurrent with the preparation of pay calculations.

Hourly information is punched and verify-punched from time and attendance cards. From this basic information current leave balances and a break-out of shift hours is prepared on the Univac 60 computer. From this operation we combine master card information to produce pay and bond information. Final result is obtained through seven computer operations.

Constant close contact must be maintained between the EAM Systems Branch of the Comptroller's Office and the Civilian Pay Unit. Close control must be maintained, and it is through the master control sheet, hourly control sheet, summary time and leave report, payroll proof sheet, bond register, and payroll for personal services that we tie the entire system together into one package.

The $40,000 annual savings mentioned previously is an accurate dollar assessment of the accomplishment that resulted from the application of mechanical and electronic procedures. Many other somewhat less tangible advantages have accrued as the result of our conversion to the new system.

Human failure in reporting has been eliminated, hence there has been a very sharp increase in reporting accuracy. Peak loads can now be taken in stride.

The system has facilitated close controls on all phases of our operation. Some of these might be considered tighter than necessary, but the machine system provides them and it is our feeling that it is always better to be entirely safe rather than sorry.

One great asset of our system is its inherent flexibility. We are now in the process of further implementing existing and contemplated additional procedures through use of our equipment and, as a result, further dollar savings of an appreciable amount are contemplated.

# Where Procurement Fits In Today's Supply System

by Lt. Col. M. J. Haas
*Chief, Procurement Management Course*
*Army Logistics Management Center*

THE field of military supply has grown to such proportions that it has encouraged the evolution of the specialist. The inventory of goods in Army depot stocks alone has been estimated to be in the magnitude of $24,000,000,000. No longer can one individual be expected to understand all of the myriad rules and regulations that control the operations of this vast empire. Top management in each of the functional areas, however, must recognize how good management in one field can improve results in other areas.

Initially it must be realized that procurement is the bridge between requirements and supply. If the requirements job is done well, the work of the procurement people becomes easier. If by becoming easier the job can be performed better, then the end result is that the distribution people can deliver the desired items to the user when he wants them.

It is also true that by the judicious use of the proper tools of procurement the load of the requirements and distribution people is made considerably lighter. Consider the overall benefit to the supply system of a method of procurement that reduces the time required to effect procurement. Obviously the amount of inventory could be reduced with all of the savings this implies, both in the dollar investment and the personnel to handle the stores.

## Examples

Procurement lead time illustrates an area in which the various elements of the system dramatically interact upon each other. When unrealistic demands are pyramided and unrealistic delivery schedules are requested, normal procurement lead time can no longer be maintained. Inevitably, the result is that as deliveries become delinquent additional quantities are placed on order which aggravates an already congested condition. In turn, this encourages hoarding by the users, irresponsible bidding by potential suppliers and frustration and inefficiency in the purchasing office.

Contracting officers and negotiators are expected to exercise sound business judgment and maintain high standards in their dealings with industry. Their negotiations should never be allowed to degenerate into an auction or haggling session. The goal should be a reasonable price, fair to the government and the contractor.

In the area of mobilization planning for emergency use of our industrial might there is an excellent opportunity for close working relations between requirements and procurement personnel. The policy of maintaining the production base in a state of semi-readiness reduces drastically the number of items that would be needed in stockpile. It is an excellent form of insurance but it is costly. By better determination of requirements the cost of the program can be reduced. Likewise, if procurement personnel can find sources to eliminate potential bottlenecks, better planning and lower costs will result.

The problem of providing repair parts to maintain military equipment in the field involves all of the functional areas of supply. Each party concerned should have its voice in making the original selection of the parts required. Too often in the past one or the other was ignored when basic decisions were being made.

The tendency is to overprocure in order to be safe. This is a needless waste of the tax dollar. It places an undue strain on the distribution system.

The ultimate supply aim is full maintenance of equipment with a minimum of parts in stock. One of the most effective means of achieving this objective is through standardization. Certainly it is far simpler to maintain one type of equipment than many, more economical to stock one kind of repair parts than many. But can this be justified if the total productive capacity of the country is to be utilized in an emergency? Can we afford to lose the advantages of competition between suppliers to attain this result? Some balance between conflicting aims must be achieved. Perhaps by better distribution of the equipment in the system a satisfactory solution can be found. Perhaps our manufacturers can assist by agreeing to effect greater industrial standardization in the area of high mortality parts.

Although vastness of the operation demands specialization, all supply managers must recognize this interactive effect and must estimate the impact of their decisions in broad terms.

# How Navy Ordnance Controls Material Quality

*The effectiveness of material in the hands of the fleet is the ultimate measure of quality. Described here are the ground rules for Navy Ordnance quality control.*

**by Courtlandt C. Van Vechten**
*Asst. Dir. for Policy, Plans, and Procedures, Quality Control Div., Navy Bureau of Ordnance*

THE effectiveness of material in the hands of the fleet is the ultimate measure of quality. To the user quality has two primary aspects—the performance that may be expected when material meets design, and the probability that the item at hand will meet expectations. The Navy Bureau of Ordnance has organized its quality-control program on the "birth-to-death" concept in order to assure that the fleet gets the highest level of quality consistent with adequate quantity of material.

It is important that the earliest prototypes submitted to test have definitely known relationship to the theoretical designs which will be judged by those tests. We cannot afford to have good designs condemned because of failures of hardware which purport to, but do not, incorporate those design ideas.

The inherent variability of things plus the practical impossibility of recognizing and controlling all variables require that many tests of design be on a statistical basis. This is particularly true when two closely related designs are in competitive test. The statistical adequacy of design of experiment is therefore essential.

Once it is decided to put a design into production, a number of steps are required to provide adequate assurance that the end product will meet performance standards.

1. An analysis is made of the end item in terms of the contribution of its elements to the performance characteristics. This is, in fact, a part of the design process. It makes possible the determination of that minimum number of elements of the design which, if demonstrated to be satisfactory, will assure the performance of the complete item. These we call "units of inspection" and they are as near the end-item stage as is consistent with practical inspectability. The actual characteristics of the units of inspection which are to be examined are enumerated and classified into a number (usually four) of weighted groups. These are designated by the possibly semantically unfortunate term "Classification of Defects."

2. It is essential that prospective producers have the capacity to produce items of desired quality. In addition to engineering competence and adequate equipment, this requires an inspection organization adequately staffed and organized and in a position to be effective. Objective measures have been devised to determine that these requirements have been met.

3. A technically and numerically adequate inspection organization must be established. It must be supplied with the information generated by 1. and 2. above plus instructions for statistical sampling (it having been repeatedly demonstrated that 100%—or several hundred percent—inspection is ineffective as well as prohibitively costly). Inspectors are backed up by engineering capability as necessary.

4. Procedure and organization for handling deviation and waiver requests and for material-review procedures must be set up, since design defects, material shortages and simple errors will crop up, and it is neither economical nor necessary to permit all of these to stop deliveries.

5. For items still undergoing development—and this includes all the guided and ballistic missiles and special weapons which are now getting the great majority of our procurement funds—it is necessary to provide competent engineering assistance to handle minor design modifications, process and material modifications, waivers, deviations and material-review problems. Having this assistance at the producer's plant has great value, especially whenever the producer has any degree of design responsibility. On-site technical competence pays big dividends in the related field of contract negotiation and administration; it also expedites greatly the administrative actions necessary.

6. It is bad when reserve stocks deteriorate and you know it. It is far worse when the deterioration is unrecognized. When deterioration is recognized a replacement or maintenance program can be instituted if funds are available and, at worst, tactical and logistic planning can be adjusted to meet the know deficiencies. Unrecognized unserviceability can lead directly to military disaster.

It is the nature of the military, and especially of ordnance, that very large inventories, in terms of peacetime use, must be maintained in order to meet wartime requirements. This long-time storage presents deterioration hazards of chemical change, rust, corrosion, fungus and deterioration of electronic components. Some items, such as electrical dry cells, have very definitely limited shelf life.

The Bureau of Ordnance maintains eight Quality Evaluation Laboratories to meet the problem of continued surveillance of Navy and Marine Corps ordnance material. These widely dispersed activities are specialized to a considerable degree in order to provide adequate coverage of the range of material. This program is in constant readjustment to meet changing weaponry. It was, for instance, recently necessary to close a facility working primarily on conventional gun ammunition in order to provide adequate coverage of more advanced weapons with the limited funds available. In addition, two mobile units designated as Mobile Ammunition Evaluation and Rework Units are maintained for on-the-spot evaluation and maintenance of material in advanced bases and in the hands of friendly governments.

## Implementation

A modest group of six officers and 49 civilians is maintained in the Bureau of Ordnance headquarters for management and direction of the Bureau's quality-control effort. The group originated within the Research and Development Division and was given independent division status in 1946. The Bureau of Ordnance believes very strongly that independence from both the design (research) organization and production is an essential prerequisite to an effective quality-control function. This conviction is based on long experience with contractors and is bolstered by the very general acceptance of this concept by industry. It follows

*(Continued on page 38)*

# Six Concepts for Comptrollers

*I understand that before he became a navigator, Columbus was a comptroller. This experience particularly fitted him for his great role. He didn't know where he was going, didn't know where he was when he got there, didn't know where he'd been when he got back, and he did it all on borrowed money.*

**by Captain V. E. Day, USCG**

*This is a condensation of an article by the same title, by the author, which was published in the February 1958 issue of the "Journal of the American Society of Naval Engineers," and is republished with permission of that society.*

IN an industrially funded military establishment such as the Coast Guard Yard at Curtis Bay, Maryland, generally accepted principles of commercial accounting are employed, except that the law precludes inclusion of capital replacement of structures, and there is no tax or insurance problem. A reasonable allowance for depreciation and obsolescence of equipment and tools is included in the indirect charges, along with military management salaries.

The Yard's entire accounting system is so designed as to give segregated costs by specific jobs. These become valuable tools for management. They are yardsticks to be used over and over as similar jobs recur, and they even come in handy to whack a juvenile delinquent, who claims out-of-line costs when no out-of-line elements except poor planning or performance can be demonstrated.

Our industrial fund operation might be said to begin anew each year in the making of the annual budget. The comptroller places a price on our operating plans. This tests their validity by reference to statistics. I'm not going to describe the making of the budget further than to mention that it stems from these principal sources of information: the approved Yard *organization*, involving all its personnel with their graded salaries; the *physical plant*, including tools and equipment, their upkeep, replacement, and obsolescence; the *workload forecast*, the only source of income; and the *material requirements* based on the prospective workload. Each cost center states its requirements and, in turn, is held approximately to the final budgeted amounts. Although the making of the budget is a more or less continuous process, we terminate the crystal-gazing period, and after we have faced East and bowed three times, praying that the blessing of Truth has been upon us, the comptroller wraps the package up.

Today's comptroller has more sailing directions than Columbus. Recently, I came across a six-part statement of the concept of comptrollership, approved by the National Board of Directors of the Controller's Institute on 25 September 1949. While I recognize this as an ideal, like the Ten Commandments or the Sermon on the Mount, and that there may be little resemblance between an individual controller and the very ethical controller of the document, it's still a good mark to shoot at, and so I'm going to borrow it. Even if I get too far out in deflection or over or short, the comptroller will still find this six-target raft a good one to tow.

## One

A lot of businesses and, as we all know, some military establishments have been run according to the old "line officer" school in times past. One thing I will say for the system, it got things done. How much it cost was another matter. In fact, no one knew, and it didn't pay to be too inquisitive, either. But time marches on. Enter the comptroller, and the Institute's *concept number one:* "To establish, coordinate and maintain, through authorized management, an integrated plan for the control of operations." In this concept, the staff officer is accorded a place at the planning table. However, it makes clear that the comptroller is still a staff man, and he must be careful not to usurp the line function of the manager. I think of all the comments I might make on how to get along, none could exceed in importance this fact of life: the necessity to recognize who is boss. To him who has the final responsibility must go the final authority. His decision is overriding, and comptrollers, as well as engineer officers, must early learn this lesson, and remember it late. His royal flush of authority can make your four-aces advice look pretty sick.

## Two

While you have been riding along a stretch of new highway construction, do you recall seeing a sort of leftover cone-shaped hill right in the middle of an excavation? Did you ever wonder about its purpose? When a surveyor lays out a grade, he refers to a primary benchmark, and then establishes secondary and tertiary marks for handy reference. That little hill had a surveyor's stake on it. It is part of his system of stakes which have grade-marks and distances on them to guide the construction crews who do the heavy work. Silly as it may look, that stake must remain there, a reference, as long as it is needed.

Our budgets are like those stakes on their little hills. Early in the game, and in concert with the engineers and top management, the comptroller views the whole project and by his budget sets the stakes. *How we are doing* is as important to managers in a shipyard as to the engineers on the highway. *How we are doing* has a substantial effect on the final outcome of every job. That is why *concept number two* states: "To measure performance against approved operating plans and standards, and to report and interpret the results. . . ." If his frequent excursions back to his reference stakes indicate agreement, things are either O.K. or maybe he is just a good accountant. But, if they fail to check out, then he must start being a comptroller and fulfil his mission of interpretation. If I am to manage, then I must have the facts, and like the engineer's, I expect the comptroller's to be as reliable.

There was a time, and not very long ago, either, when the only financial appraisal of our projects consisted in adding up all the bills and subtracting from the funds originally apportioned. As frequently as not, there was a negative balance *and then* the scramble

to augment the funds and get the account out of the red. That red was somehow, by accusation or inference, reflected in the faces of those who were trying to manage the work and the funds. You remember, I am speaking from experience. We were amateur skiers trying to make an ascent and, between stopping on the opposite ski and sliding backwards half our forward progress, we didn't do so well. Enter the comptroller. With his new business machines and a new concept of service, he has installed a ski-lift up the mountain. Now, we can hitch a ride instead of doing it the hard way; and the trip down, our real objective, is pure sport. Oh, I'm not forgetting that there will still be a spill now and then, and we'll turn up with a red place or two. But it will probably be elsewhere than on our faces.

The comptroller—now in the role of doctor—discusses: How did it happen? Where does it hurt?

There are several kinds of doctors besides horse, and many of them are specialists. If the comptroller hospital is properly staffed, there will be specialists in accounting, budgets, business machines, methods, etc. And just as the modern hospital turns out staff work by all who have seen the patient, so the comptrollers must make up their financial report; and, like the medical report, it must be in terms we can understand. And we don't expect an oversimplification like: "The patient died." We hope it will say, "The project is solvent," but if not, then we need his interpretation of what we *did* or *didn't do*. The modern patient-manager (you notice I didn't say impatient) has a right to expect this sort of treatment.

## Three

*Concept number three* calls for a measure and report on the validity of objectives, and consultation with other segments of management for policy or action in pursuit thereof. The comptroller traces the history to help evaluate the situation. The same is true when considering the continuing flow of new ideas, so earnestly sought by management. It is not necessarily indicative of idle dreaming that the round filing cabinet beside the manager's desk gets some of them. It merely means that evaluations have been made; cost disciplines are being enforced; stability and guidance are replacing do-it-as-it-turns-up thinking. Thus, we are not surprised by the bill.

With the arrival of every ship in the Yard, it is customary for the ship's commanding officer to call on the commanding officer of the Yard. Later, the call is returned aboard ship. This is all part of my job as manager, and it involves customer relations. We talk about a number of things, but one subject always seems to crop up—that of finances. Although we have him as a captive customer, and the money he is spending does not come out of his pocket, you may be sure he is interested in getting the most for it. He has to live with the product his money buys, and, I might add, as often has to live without what he would like to buy if he had the money. He and the planning officer have to make the decisions.

But, it frequently happens that some jobs are finished sooner or at less expense than anticipated, thus releasing funds for other cherished work. It is important to him that knowledge of the state of his account be current. Here the comptroller is worth his weight in gold for customer relations. Any slowdown knocks him off the gold standard, but fast. This is hardly the "action in pursuit thereof" envisioned by our ideal.

## Four

The *fourth concept* has to do with taxes and reporting to other government agencies. It's written as a quickie, and I'll dispose of it the same way. We are already acquainted with government methods, and by merely perusing a dozen or so two-to-three-inch-thick manuals and entering a hundred or more pages of changes every year, we can keep right up to date. Remember, the boss expects it of the comptroller. But, don't worry, if you make a "boo-boo," the comptroller general's staff will back you up, even if it takes seven years.

## Five

*Concept number five* has to do with the effect of external influences, and it has less application in military comptrollership, because we have what might be termed a captive trade, and we ourselves are captive to higher governmental pressures. I am going to turn it about and apply the same reasoning to internal influences. Unlike business, as defined in the usual sense, profit is not the motivating force of the government yard. Yet, to say that we are not interested in *all* the motives which normally produce profit would be a far cry from the facts. As a manager, I am intensely interested in securing the maximum output of the highest quality work at the minimum cost. Only a dreamer would expect this attitude to be reflected from supervisor to supervisor on down to the production workman. Somewhere along the line, a mirror is apt to be dirty, or even more likely to be a little out of kelter; hence, the idealistic beam gets lost en route. Yet, if we are to achieve economy in our operations, somehow we must reach the man with the welding hood. It is difficult to speed production; we are forbidden to pay incentive wages. Our men work strictly on a time basis; their output is not a factor in their pay. High quality can be obtained, but seldom speed. The workman is little interested in costs. The country's 73 billion dollar budget seems like a mighty big reservoir compared to his hourly wage. It's like trying to get your family to shut off the tap to stop the drip by saying water costs money. They know it's only a few cents a thousand gallons. Nor do you fare much better by crying "water shortage" when they can look out the window and see it raining. If you get tough, then it's always, "Why pick on me? There are others who waste more than I do."

As keeper of the keys, comptrollers have a role in this difficult task of securing cooperation at the worker's level. With men, and this applies to you and me, all of us, every motion is preceded by emotion. The task before us is to stir up the right kind of emotion. "Nah, I don't wanna!" is the one reaction you are sure to get on the waterfront if you say, "Step lively!" But, if the production curve fresh posted from the comptroller's office points the way, the leadman's cheery,


Spot and prevent trouble at a glance

NEW! VU-BOARD®

BY THE ORIGINATORS OF WALL BOARD CHARTING AND PRODUC-TROL

Low cost — unlimited Visual Control

- Shows all important data—a fast, accurate, complete picture
- Easy to set up and operate—wall or desk use
- Boards fit together horizontally or vertically to increase item capacity
- Inserts can be shifted *without* removing from board
- Solves all machine load problems
- Unlimited uses for scheduling, charting, dispatching, etc. — in all phases of business and industry
- Light, compact all metal construction—designed for a lifetime

Only $49.50 complete

PATENTED

Phone Westport, Conn. CA 7-4111 or write

WASSELL ORGANIZATION, INC.

Westport, Conn.

IN USE IN ALL BRANCHES OF GOVERNMENT
WRITE FOR NEW BOOKLET "VU-BOARD"
or
Consult our GSA Federal Supply Service Contract Class 54—Part III—Sec. B—Cont. No. GS-00S-15367 GSA Distribution Code 7B & 7D Item No. 54-1-675

For more facts request No. 7 on reply card.

"Let's get the job rolling, boys!" is worth a thousand words. I honestly believe most men would do better if they knew better. How can they know, if the comptroller who is "in the know" doesn't tell them?

The comptroller should be as quick as the production superintendent or the personnel relations man to spot trouble brewing. The story will come to him by a different route, most probably through his figures. To learn, interpret, report, and suggest a solution is what I expect from the comptroller.

## Six

*Concept six* provides for the protection of the assets of the business. The first requirement is to understand what those assets are. Take a row around, and size up what you can see. Then back off a little, to better your perspective. Evaluate the submerged seven-eighths. It's there all right. Thus, you will acquire respect for that of which you are but a small part. I am not talking only about the physical, but about our entire heritage, the "blood, sweat and tears" of our predecessors. *Respect* and *protect* the traditional policies of management, the precedents and the good will which have built our establishment into today's going concern.

Responsible teamwork in the public interest is essential. Comptrollers have a vested interest and a clear duty to perform in upholding the moral principles required of government-in-business.

Be conservative in your judgments, and you won't go too far wrong. But, a word of caution, too. Don't be an old man before your time, lest you let conservatism stand in the way of progress, and it will. "Without vision, the people perish." Part of that vision is dreaming and scheming, even doing a little exploring in dangerous waters.

I have a friend who was so busy landing an Alaskan salmon he did not take time to watch out for a big brown bear behind him, and who, immediately the fish was landed, took possession of it, while my friend beat a hasty retreat downstream. Preoccupation with accounting, or payrolls, or the complicated modern machines thereof, means withdrawal from overall management viewpoints. I admit it's hard to be looking everywhere at once, but that is where true comptroller staff work comes in, to be lookouts for the interlopers—the profit snatchers—who gobble up the catch, not to mention scaring the pants off the manager in the bargain. For any period, in retrospect, we need more than a fish story, no matter how interesting it may be. We need fish! While the production department is catching them, and the planning department is luring others into range, and the supply department is bringing up more fishing gear, the comptroller department must be watching and warning. The boss comptroller must be the oversize and complicated lens which puts the combined work of his department on a Cinemascope-sized screen before his management audience.

Comptrollers who are able to live up to the six concepts their own people have written will be pretty close to paragons of comptroller virtue, and will be doing what the top manager expects.

---

## Navy Quality

*(Continued from page 35)*

that the Bureau's organization reports to the first echelon with overall responsibility for the product, in this case the Chief of the Bureau.

The internal organization of the division reflects the fact that it has both line and staff-type functions. Under the Division Director, and his assistant (military) are a group of four staff assistants, five line branches and a general admininstrative unit as follows:

Staff Assistants for: inspection, surveillance, engineering, statistics.

Line Branches for: weapons, ammunition and explosive components, missiles (including missile-systems items), technical instructions and operating procedures, statistics.

An administrative branch.

## Management Techniques

The Bureau of Ordnance believes that it has done a conspicuously good job in the area of quality control. It believes that job is the result of conscientious adherence to a number of important management concepts and tools. Many of these are familiar to all readers, and a few that are particularly important in this area are worth some discussion.

1. The principle that quality control must be independent of design and production has been mentioned. It is impossible to overemphasize the importance of this item either in the Bureau, our own field establishments or contractor organizations.

2. Devotion to sampling as distinct from 100% inspection. This concept has had general acceptance for the last dozen years but that acceptance was not won without a long, hard fight. Sampling procedures continue to receive attention as in the areas of continuous production lines and inspection by variables.

3. The concept of the classification of defects. Bureau of Ordnance has pioneered work in this area. Classification, and its associated concept of units of inspection, has greatly reduced the number of items that are inspected and the characteristics that are considered by reducing the things looked at to those which will significantly effect the end product. It has also made practicable much greater delegation of authority for action to field activities.

4. The Bureau of Ordnance Cooperative Industry-Government Acceptance Inspection Plan (CIGAIP). This is a device for making maximum effective use of company-generated inspection data. Use of such data permits savings to both industry and the government. The safeguards of this particular plan are such as to both protect the government from the acceptance of bad material and protect the sound producer from losing business to irresponsible bidders. This last feature is of great importance in our business since most of our contracts are let on competitive bids to meet government design specifications.

5. The Contractor Inspection System Rating Procedure, by which we, with contractor cooperation, evaluate the features of his organization and procedures against an objective standard. Deviations from standard are weighed. Perfection is not expected but both we and most of the contractors we have worked with are convinced that this device is a real aid to both contractor efficiency and our effectiveness.

6. The insistence on surveillance. This was prompted by bad experiences early in World War II. With the cooperation of the fleet (practices are now run with service material) and careful use of flowback data from users, we are in a position to know just what can be expected of the material in store.

7. Finally, and as important as any single consideration, we operate with an integrated womb-to-tomb concept of quality which makes possible a consistent long-term approach to quality problems, provides a focal point for user feed-back, and makes possible integrated planning and management of the quality problem.

## Problems

Our problems, like those of all other military operating groups, are not all solved, and some may not be solvable, at least within the area of authority of the military operating services. With the increasing technical sophistication of modern devices, the quality problem —frequently designated by the term "reliability"—is increasingly difficult and its adequate solution becomes increasingly imperative. This is our major continuing task.

# A New Way to Analyze Funds Audit Reports

**by Victor Gailey**

*Assistant for Management Analysis*
*Hq, Oklahoma City Air Materiel Area*

GUARDING the taxpayer's interest with sound management operations is of paramount importance to comptrollers worldwide. Within the Air Force's logistical arm, the Air Materiel Command, the job is a ten-figure budget responsibility.

At headquarters of the Oklahoma City Air Materiel Area (a giant industrial installation and AMC's prime headquarters for field management of the B-52, B-47, KC-135, and other first-line weapons, as well as engines and accessories), the analysis of funds audit reports has been put to a significant test.

In 1954, our OCAMA accounts stood at a 62% average of a clean "bill of health." This percentage is sound, but in 1955 the percentage dropped to 51% followed by a sharper decrease to 22% in 1956. Such an adverse trend over a three-year period indicated need for positive change.

A number of serious problems, contributing to our downward trend, were apparent. A recently completed study demonstrated also that our problems could exist with other managers. Here are the objectives of the study and how they were met.

**1. Identify the Problem Area Accounts:**

This objective was set up first for three reasons: (1) To establish at the outset that the larger overall OCAMA problem is traceable to individual accounts; (2) to establish organizational administrative responsibility for these accounts; and (3) to eliminate unnecessary data-gathering by narrowing down the problem to a consideration of only the problem accounts.

The Air Materiel Areas and Depots were rated on this subject in the Headquarters, AMC Management Evaluation System. The method is quite simple. Audit ratings of "Adequate," "Partially Inadequate," or "Inadequate" are based upon comments and recommendations made by the resident auditor in his reports. This method is applied somewhat as follows:

*Adequate:* An account is considered adequate when the audit reports contains no stated deficiencies. It may also be considered adequate when the auditor's recommendations are of an opinionative nature.

*Partially Inadequate:* This rating is given to an account when the auditor states that controls and procedures are generally adequate "except as follows" (in which case, he cites certain deficiencies such as a violation of regulations, a repeated deficiency, or a deficiency that involves more than one directorate).

*Inadequate:* When the auditor states that as a result of the audit it is his opinion that the system of internal control, appropriate records, and supporting documents maintained are inadequate and presents sufficient evidence, the account is considered inadequate.

By using this method, it is possible to evaluate all audits performed at an installation and quickly determine those accounts in the problem-area category. Since this method of evaluation is one of the standing operating procedures at OCAMA, the job of finding the OCAMA problem accounts was a simple process of searching past records and then tabulating the results. Of the total number of accounts audited, only those which had failed to receive an adequate audit during the entire period—1954, '55 and '56—were selected for further analysis.

At this point in our study we know the accounts giving us trouble and the organizations which are administratively responsible for them. The next step is to determine the discrepancies and what caused them.

**2. Determine Discrepancies and Causes by Account:**

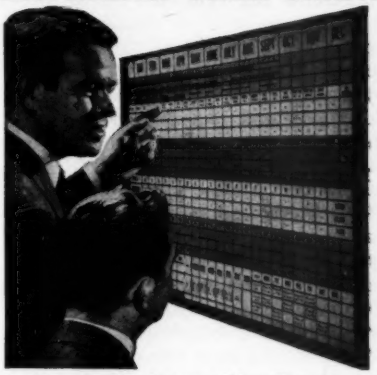
This objective may be accomplished by a process of evaluation, determination, and tabulation. The auditor's remarks in his reports determine the discrepancies charged and also the discrepancy causes.

It was found in our review of the audit reports that most discrepancies resulted from not one but a combination of causes. In most instances, causes were specifically spelled out by the auditor, and it was found that they could be tabulated and classified in the following five categories: (1) Noncompliance with Regulations (Manuals, Technical Orders, etc.); (2) Lack of Controls (Supervisory, Document, Inventory, etc.); (3) Inadequate Procedures; (4) Clerical Errors, and (5) Poor Accounting Practices.

Also, at this point some of the actions that will be required by responsible operating officials and interested staff components, *i.e.*, comptroller, and inspector general, are becoming obvious.

As an example, in reviewing the

**You Get Things Done With Boardmaster Visual Control**



☆ Gives Graphic Picture of Your Operations—Spotlighted by Color
☆ Facts at a glance — Saves Time, Saves Money, Prevents Errors
☆ Simple to operate — Type or Write on Cards, Snap in Grooves
☆ Ideal for Production, Traffic, Inventory, Scheduling, Sales, Etc.
☆ Made of Metal. Compact and Attractive. Over 250,000 in Use

Complete price $49.50 including cards

FREE 24-PAGE BOOKLET NO. AM-30 Without Obligation

Write for Your Copy Today

GRAPHIC SYSTEMS
55 West 42nd Street • New York 36, N. Y.

For more facts request No. 8 on reply card.

GM GENERAL MOTORS · GE · IBM · RCA · Kodak

MONTHLY INVESTMENT PLAN

Hamilton Funds is an investment plan through which you can share in the ownership of over 80 major corporations, for as little as $10 monthly. Write for information.

Hamilton Funds
Dept. H-2
Box 4210, Denver 9, Colo.

Please send me prospectus booklet without obligation.

Name

Address

City State

For more facts request No. 9 on reply card.

four audits performed on a representative account during the three years, it was found that a lack of controls occurred 63 times; noncompliance with regulations, 42 times; inadequate procedures, 20; poor accounting practices, 8; and clerical errors, 15 times, for a total of 148 causes of audit discrepancies. The big problem in this account obviously is a lack of controls.

**3. Determine Relative Seriousness of Discrepancy Causes:**

As an example of outstanding cooperation, this phase of the study was accomplished, almost in its entirety, by the OCAMA resident auditor. He developed and recorded, perhaps for the first time, a system of placing discrepancies into three categories by which they can be objectively evaluated. These categories are: Minor, Intermediate, and Major. He then established a method of evaluating the relative seriousness of discrepancies found in these categories. Minor discrepancies were established as the base with a relative seriousness or weight of one (1). Compared to a Minor discrepancy, a discrepancy placed in the Intermediate category would be four (4) times more serious or have a weight of four (4). Discrepancies placed in the Major category would be fifteen (15) times more serious or have a weight of 15. This method is further described by error characteristics and results as follows:

*Minor Discrepancies:* (1) Individual errors; (2) Minor administrative deficiencies.

*Intermediate Discrepancies:* (1) Unreliable reporting, the impact of which cannot be fully ascertained except it generally does not affect mission accomplishment to a serious degree; (2) Lack of procedures and internal control; (3) Noncompliance with regulations, technical orders, manuals, etc., and (4) Irregular practices which are not in the best interest of the Air Force.

*Major Discrepancies:* (1) Direct or potential loss to the Air Force; (2) Discrepancies which have an adverse effect on reports or the reporting systems, resulting in misplanning and hindrance to mission accomplishment.

To further assist in the study, the OCAMA resident auditor placed every discrepancy recorded during the three-year period studied into one of these three categories. Now to show how this method works, we again refer to the representative account used in the preceding section, the account with 148 causes contributing to audit discrepancies. This time, however, by assigning the same weight of seriousness to the cause as to the discrepancy itself we find that of the 148 causes, 43 are Major and 105 are Intermediate. This gives us a total weighted value of 1,065 for discrepancy causes for this account. The same form of tabulation is then used for each of the problem accounts originally selected for analysis.

This method of analysis lets us know two things: (1) The number and percentage, in total and by each separate account, of discrepancy causes which result in Major, Intermediate, and Minor discrepancies. If 20% of the total number of discrepancy causes identified result in Major discrepancies, a condition exists that is obviously more serious that if the percentage was five or less.

The next fact to establish, in our progress toward a completed study, is whether or not effective action is being taken on all discrepancies noted on each audit report immediately upon receipt of that report. We can do this by determining the number of discrepancies which have been repeated in the two most recent audits. This problem may be considered more pressing if discrepancies have been repeated in the last three or four audit reports.

**4. Determine Repeat Discrepancies:**

This is done by reviewing the working papers developed during the previous phases and tabulating the repeat discrepancies. Here we are considering discrepancies as such, not discrepancy causes. Again, as in the previous section, this analysis enables us to determine those accounts in which attention should be concentrated first. Obviously, it does little good for a discrepancy item to be cited by the auditor over and over again in his audit reports.

The remaining three objectives (analyze and record findings, submit report, and determine follow-up) are common to a complete study in any area and, of course, need not be covered here.

In summary, this method of analysis will establish whether or not there is a problem in the area of appropriated and nonappropriated funds audits, which accounts are responsible for the problem, and who is responsible for these accounts; also, what is causing the problems within each account, and the extent of seriousness of these problems; and finally, which accounts should be concentrated upon in order to get at the more serious problems first.

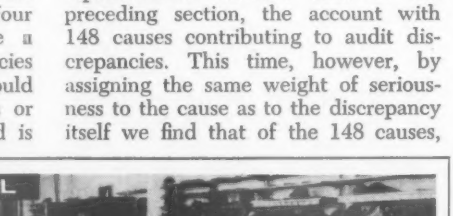
It is too early to report results of our subsequent follow-up action; however, we are confident that our OCAMA study has provided a sound approach to one analysis problem, and is generally applicable as a guide to similar studies.



*Typical installation of Wassell Sig-Na-Lok visible cabinets—used at a St. Louis Depot for an inventory of Army vehicles, planes and replacement parts—*

**Reduce Costs**
**Prevent Losses**
**Create Profits**

**Signalled facts**
**STAY FACTS**
**with SIG-NA-LOK®**
*No undesired slipping of signals.*




**SIG-NA-LOK®**
***SIMPLIFIED***
**INVENTORY CONTROL**

Sig-Na-Lok visible control puts your inventory at your fingertips. Every fact needed for effective control is signalled and the signals are locked until the facts change. In one complete record, you'll always know exactly what's on hand and when to reorder. Take the guesswork out of inventory — switch to Sig-Na-Lok and you'll

Prevent over stocks • Eliminate out of stocks • Increase turnover • Decrease costs — increase profits

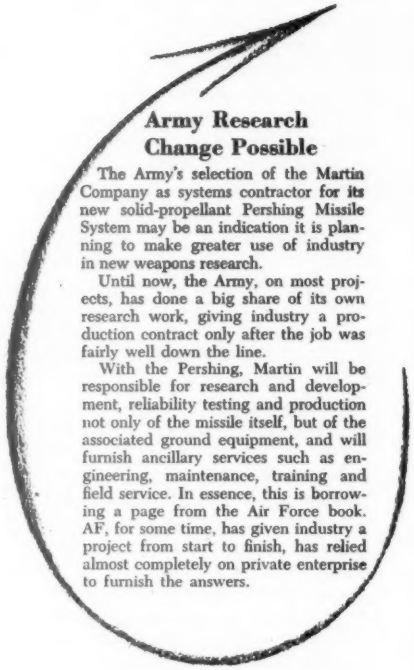
**Creator of Effective Tools for Effective Management**

Phone Westport, Conn. CA 7-4111 or write
**WASSELL ORGANIZATION, INC.**
Westport, Conn.

**IN USE IN ALL BRANCHES OF GOVERNMENT**
**WRITE FOR NEW BOOKLET "SIG-NA-LOK" SIMPLIFIED INVENTORY CONTROL**
or
Consult our GSA Federal Supply Service Contract Class 54—Part III—Sec. B—Cont. No. GS-00S-15367 GSA Distribution Code 7B & 79 Item No. 54-F-2325

**For more facts request No. 10 on reply card.**

*Dear Sir: On page 18 of the April issue . . . you have an article titled "Army Research Change Possible." If a change in Army's* modus operandi *with regard to weapons development does occur, it is certainly a hard blow to the security of our nation. Dr. H. A. Wilcox recently gave an interesting address on this subject which I would sincerely recommend your publishing.—a reader.*



**Army Research Change Possible**

The Army's selection of the Martin Company as systems contractor for its new solid-propellant Pershing Missile System may be an indication it is planning to make greater use of industry in new weapons research.

Until now, the Army, on most projects, has done a big share of its own research work, giving industry a production contract only after the job was fairly well down the line.

With the Pershing, Martin will be responsible for research and development, reliability testing and production not only of the missile itself, but of the associated ground equipment, and will furnish ancillary services such as engineering, maintenance, training and field service. In essence, this is borrowing a page from the Air Force book. AF, for some time, has given industry a project from start to finish, has relied almost completely on private enterprise to furnish the answers.

# What Is Wrong with Our Missile Program?

**by Dr. Howard A. Wilcox**

*Head, Weapons Development Department*
*U.S. Naval Ordnance Test Station*
*China Lake, California*

THE title of this talk poses an important—even vital—question. It asserts that, as a nation, we have been making less progress than we have a right to expect—indeed, less progress than the Russians have—in developing newer and more powerful guided missiles. This is true, I believe, and I will shortly attempt to set forth the basic reasons, as I see them, for this alarming fact. But before doing so, let me say that behind this narrow question—What is wrong with our national guided missile program?—lies a bigger question—How are we going to live in this small world, with the Russians, with the Africans, with the English and the Chinese, with our new knowledge and our new strengths? Our national guided missile program acquires its full meaning only in relation to this larger question. And much of what is wrong with our guided missile program stems from our national failure to answer this bigger question—from our failure, as a nation, perhaps even to recognize the existence of this bigger question.

I suppose I should say at this point that I am speaking here only for myself, and in no sense do I officially represent the Navy or the U.S. Government in the views and conclusions I shall present.

Well, to begin with, our missile development programs have recently faltered, in my opinion, for the simple reason that we have for the last few years based our governmental administrative policies on the idea that our private industry can all alone develop and produce the required weapons, if only enough money is made available. I say this idea is wrong. American industry is, in my view, rather skilled in making both capital equipment and very large quantities of a very large variety of consumer goods. The profit motive automatically works to produce this result. And this result is clearly desirable in the field of peacetime consumer goods. But the development of remarkable new weapon systems is a very different business from the manufacture of new capital equipment or new consumer goods. Industry is not skilled in—nor does the profit motive encourage close attention to—the complex realities of military operations and of nature, as necessary for the successful, rapid, and economical design of radical and reliable new weapons. Unfortunately the military contracting officer cannot by himself remedy this situation, for he is also out of touch with nature.

To find the remedy, we need only remember our wartime way of working. The nonprofit laboratories of the Naval Research Lab and the Army's Signal Corps and the Massachusetts Institute of Technology developed radar. The nonprofit laboratories of the National Bureau of Standards and of the Johns Hopkins University developed proximity fuzes. The nonprofit laboratories of the California Institute of Technology and the Naval Ordnance Test Station developed rockets. The nonprofit laboratories of the Universities of Columbia, Chicago and California developed the atom bomb. These wartime laboratories were all truly national—yes, governmental, even military—in character. Industry gave them magnificent assistance—production assistance, that is—once industry was informed rather exactly what was wanted.

Today the Government still operates or supports many nonprofit laboratories for weapon research and development, but the face of broad governmental interest, trust and support has been turned away. The McCarthy damage has never really been repaired. Military security measures, ostensibly designed to keep our precious weapon secrets, have actually produced a dangerously misinformed and confused American public, while simultaneously revealing much to the careful analyses of foreign governments.

J. R. Oppenheimer was dismissed. E. U. Condon was dismissed and hounded. The staff of the Monmouth Signal Corps Laboratories were demoralized. The Army's well-qualified staff at the Redstone Laboratories were told to restrict their efforts. The list goes on and on.

Meanwhile, the Government has put more total dollars than ever before into the effort to develop new weapon systems directly in industry. The government has spent literally billions of dollars on missile concepts which were either useless to develop in the first place, or else merely impossible to develop as specified. A truly frantic effort has been made—abortively—to develop some sort of weapon-type defense for the Continental U.S., despite the fact that only a relatively few enemy bombers, or rocket-armed surface vessels, or rocket-armed submarines or saboteurs with suitcase-bombs would be able to defeat all such defensive systems. This frantic effort to develop impossible defensive weapon systems has been abetted by a public ignorance born of military security, and has been bought at the price of inadequate and mistaken efforts in relation to the more important and more effective deterrent weapons, dispersal and shelter of the civilian population and constructive works for international peace.

The natural and direct effect of removing governmental trust and support from the nonprofit development laboratories has been, as I see it, a mushroom growth in the number of technical review committees in Washington. Clearly the governmental officials require competent advice from sources other than the interested commercial firms, and, so, many technical review committees have been organized and set to work. But committees, equally clearly, cannot do the required job, and the result appears to have been near paralysis in the decision-making powers of the Government.

You will notice that I have not mentioned, as primary difficulties, unification of the three military services, nor increased efficiency in Government, nor the need for more money in the missile program, nor the shortage of scientists and engineers. I personally do not regard the alleged competition among the military services as particularly important in relation to this problem, even though many newspaper editorials and many congressional utterances would have you think so. The alleged interservice competition is, in my opinion, largely a newspaper battle inadvertently abetted by some of the military departments in their attempts to gain their budgetary goals.

With regard to alleged inefficiency and waste in Government, I do not feel that the nation can be operated as a profit-making business. On this latter view it would be argued that since Government operations make no profit, they are analogous to an "overhead" item which good and efficient management reduces to the smallest possible extent. But I say the analogy is incorrectly drawn—the Government makes possible the existence of law and order within the land and should provide for the common defense. Today it does a poor job of fostering effective modern weapons, because it has forgotten that the Government-supported nonprofit research and development laboratories are a necessary and vital element for supplying detailed information to industry so that they can manufacture capable weapons for the military.

As for requiring more money in the missile program, it is my considered view that more than enough—far more than enough—is available now and has been available for a very long time. Industry and government alike are plagued today by the so-called "cost-plus-fixed-fee"—or "CPFF"—contracting system, where the so-called "fixed-fee"—or profit—is actually a percentage of the original cost plus any "change-of-scope" overrun that occurs. This system is, of course, made necessary by the mistake of asking industry to do its natural job—manufacturing—before a nonprofit laboratory has carried out the basic research and development work—that is, by asking industry to do a "best efforts" type job on a CPFF basis before anybody can reliably predict success or tell industry exactly what is wanted. It is an invitation to—in fact it practically forces!—shady bidding practices and large "red tape" staffs in both Government and industry to handle the renegotiation and cost-overrun arguments.

Additionally, the high industrial salary scale—supported as it is by Government contract—is a plague to both Government and industry. It strongly encourages both industrial manpower hoarding and "salary climbing" by the individual who puts salary ahead of job responsibility. In fact it is now a profitable line of business—called "management consulting"—to find jobs for individuals and individuals for jobs. Their motto seems to be: "If you're not making twice as much as your present job pays, then you're in the wrong job."

Perhaps there is a shortage of scientists and engineers. We are always short of creative and wise people in every field. Certainly I strongly support the idea that we are long overdue for an honest public recognition of the value and the necessity for enhanced public wisdom and public knowledge of all sorts in expanding and defending our culture and our way of life. But crash efforts in this field are impossible. Here we must build for the long pull into the future by improving teacher salaries, raising teacher and student educational standards and humbly recognizing that knowledge and wisdom are difficult to acquire but easy (and dangerous) to forget. In the meantime, a return to the sound direction of military contracts by way of our nonprofit government laboratories will tend to reduce industrial hoarding of skilled manpower, and so will immediately alleviate the present shortage of scientists and engineers.

So much, then, for the more immediate answers to the question "What is wrong with our national guided missile program?" In summary, I should say we need again to recognize that the Government-supported nonprofit research and development laboratories are essential to our weapon development programs and are required to cooperate with and to inform our industry exactly what is wanted for manufacture in the weapons field. The "cost-plus" type contract with industry should be eliminated, in my opinion, so as to eliminate shady and shoddy negotiation practices plus industrial hoarding of trained technical manpower. We need to minimize our military security system and to adjust our national thinking to the realities of modern weapons—to the fact that large-scale efforts put into the development of ineffective and impossible defensive weapon systems are not only wasted, but they actually prevent us from putting adequate efforts into education, dispersal and shelter of the population, and other constructive solutions to the U.S. and to international problems. Finally, we need to avoid the all-too-attractive error of thinking that "unification of the armed forces" or "bigger budgets and more taxes" will solve our problems. These steps may give us the comfort of doing something, but they will not solve our problems of survival. Indeed, they are probably steps in the wrong directions.

But what of our larger problem?

Right now it is clear that we badly need new and improved weapons. And it is urgently necessary for us to correct our national approach to developing these more effective weapons. But there can be no ultimate national safety or national satisfaction in a weapon development program, however successful, which is unaccom-

panied by effective approaches to solving the larger question of how we expect to live in this small world with our new and frightful weapons.

It seems to be one of our fixed ideas that Russia is implacably bent on waging a hot war with the U.S., and that every Russian move is—and has been for 30 years—carefully calculated to the single end of hastening our downfall. Maybe so—but such an idea leads to no constructive course of action on our part. I say that we stand to lose nothing, and to gain a great deal perhaps, by adopting the idea that the Russians, like other nations, are somewhat flexible, sometimes confused, and often act in what appears to them to be the clear interests of their own survival and well-being. Our responsible officials must therefore make clear to us, to the Russians, and to all others, that the survival and well-being of every nation is contingent upon the prospects for the survival and well-being of each nation—as foreseen by that nation.

With regard to our national debt, I believe it to be primarily a reflection of the fact that some of our national effort has been, and is being, diverted to activities—like weapon development—not productive of wealth. But the national debt is internal—owed to the nation, by the nation—and as long as our national morale and knowledge and energy and inventiveness and productivity hold out, I, for one, fear no imminent collapse of our economic system.

A rather favorite idea, frequently heard these days, is that "creeping Communism" could "defeat" us without our ever firing a shot. This is so, I suppose, if we adopt the narrow view that America is just defending the status quo. But if we in America go strongly and clearly forward in effectively exporting our techniques for creating wealth, and in effectively exporting our political concepts of civil rights and representative government, then indeed American democracy will have seized the initiative and our cultural concepts will be difficult to defeat, shots or no shots.

I do believe that the U.S. economic and political system is—and should be—and should be stated by us to be—a flexible mixture of private and public ownership of the means of education, research, development, production, distribution, consumption and communication. And I believe that the Russian economic system is a mixture of private and public ownership which unfortunately supports a tyrannical government. This tyranny is the very opposite of that foreseen by Marx—sufficient proof of the faultiness of his prophetical visions and dialectical theory of social history—and it possesses most of the inflexible and extremely undesirable features of all tyrannies since history began. If we are to escape a major castastrophe, this tyranny must be revised from within.

What will the world be like in another five or ten or fifteen years, when Britain and France and Turkey and West Germany and Norway have light, high-yield atom bombs—and so do Egypt and Czechoslovakia and Yugoslavia and India and Israel and Argentina and South Africa, etcetera, etcetera? This is truly the ultimate destination and end of the present international weapon development race. The problem it represents is a challenge to the best and the most flexible leadership we can muster. It makes mandatory, in my considered opinion, a strong and immediate national program to disperse our population and our work-centers. It makes mandatory, I believe, immediate U.S. leadership and support toward the establishment of an adequately strong central world government to create and enforce world law. And it makes mandatory the inauguration and effective operation of a U.S. foreign policy, which—in enlightened self-interest—is based on a program to assist all "have-not" nations to raise their standards of living, until every nation finds that it, too, has much to lose by the outbreak of war.

---

# Budget Procedures Change Proposed

A recommendation that opposing factions abandon the fight over the present appropriations system *vs.* the old contract authority and tackle the important issue—"the need to project the budget into the future and to review long-lead procurement as its proceeds"—has been handed Congress.

A program for improved budget procedures had been presented to the Joint Congressional Economic Committee by a leading economist, Arthur Smithies of Harvard University. His proposals for a new look at the confused budget system were released in November, along with recommendations on the nation's fiscal policies by other top economists.

Concentrating on the defense budget, Smithies criticized current attitudes about the way an adequate defense program should be financed. He cited these four major trouble spots:

(1) Impossibility of relating actual financial figures in the budget to any meaningful concept of military effectiveness. "We have had recent examples where in one breath the Secretary of Defense asserts that not one dollar can be cut from the budget and in the next orders drastic cuts in military procurement. I suspect that he has no solid factual support for either position," he said.

(2) Amateurs rather than professionals are assessing the impact of the budget on the national economy. "I must regretfully report that bankers and businessmen usually carry more weight in public discussion of economic matters than do economists."

(3) Failure of Congressional budget-cutting to eliminate waste.

(4) The outmoded techniques applied in budget preparations. "The budget has always been prepared, considered, and enacted on an annual basis; but, with the defense budget in particular, decision must be made today whose effect will be felt for years in the future. A new weapon takes years to develop and years to produce," he said.

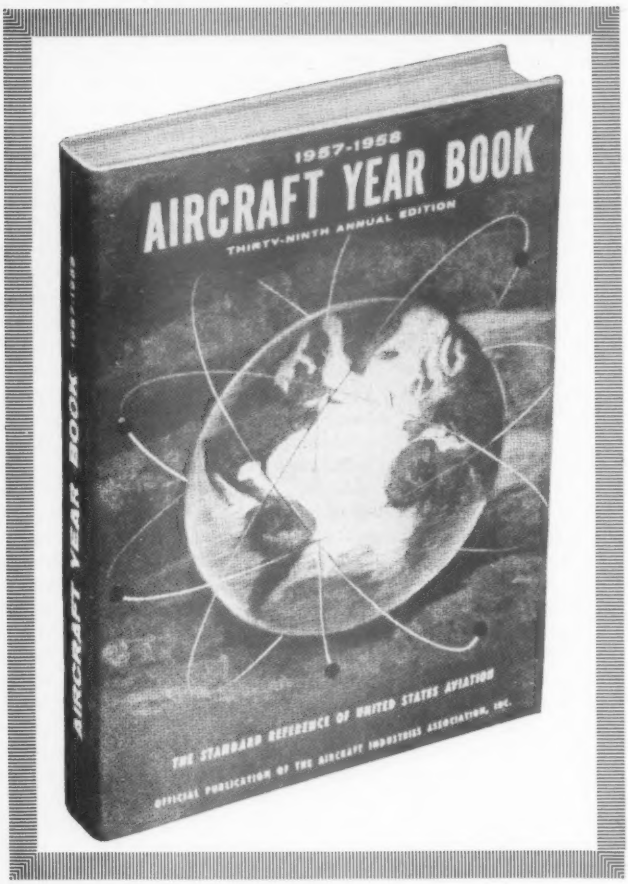
As improvements, he suggested:

(1) A program for a meaningful demonstration of what military forces are to be supported by the budget. The proposal would make a distinction in "strategic" *vs.* "tactical" forces, putting the first (including SAC and the Continental Air Defense Command) in a strategic budgetary category. Tactical, according to the economist's plan, would include virtually the whole of the Army, the Marine Corps, and tactical air and air transport. R&D would be shown differently.

(2) A professional economic analysis on what the nation can actually afford in continuing defense expenditures.

(3) Reduction of "needless" interservice rivalries; stepped-up efficiency through "bold experimentation" on budgeting, and junking the theory of applying business criteria to the conduct of military operations.

(4) Abandonment of the controversy over annual contract authority *vs.* regular appropriation methods and adoption of techniques aimed at projecting budget needs in the future, with provisions for continuing review.




**OFF PRESS**

***Standard reference of U. S. aviation***

# AIRCRAFT YEAR BOOK FOR 1957-58

**THE 1957-58 EDITION offers more to its readers than ever before. *Completely redesigned* throughout, the book contains more valuable information, more illustrations, more diagrams, more of everything than in any other issue in the thirty-nine years that *Aircraft Year Book* has served as the aircraft industry's own official record of its activities and accomplishments.**

**Aviation's standard reference for nearly four decades, *Aircraft Year Book* is now edited and produced by American Aviation Publications, the world's largest aviation publisher. The new 1957-58 edition, encompassing the most complete review of American aviation ever assembled, is now available.**

**385 photos 98 drawings 432 pages**

- Photographs, specifications, and three-view drawings of planes, engines, and missiles now in production.
- A pictorial review of outstanding aviation events of the past year.
- A summary of aircraft company and airline operations during 1957.
- A digest of current aircraft and missile research progress.
- A survey of aviation activities in the Army, Navy, Air Force, and other government departments and agencies.
- A chronology of American aviation history from its early beginnings to the present day.

**OFFICIAL ANNUAL OF THE AIRCRAFT INDUSTRIES ASSOCIATION**

**CLIP THIS COUPON TODAY**

*Please send me . . . . copies of the new*

**AIRCRAFT YEAR BOOK FOR 1957-58**

**AMERICAN AVIATION PUBLICATIONS, 1001 VERMONT AVE., N.W., WASHINGTON 5, D. C.**

☐ **Remittance enclosed** ☐ **Bill me later**

Name _____ Title _____

Company _____

Address _____ ☐ Home? ☐ Business?

City _____ Zone ____ State _____

**$6 per copy in U. S., Possessions, and Canada.**

**$8 per copy in all other countries.**

# Problems In Technical Publication Management*

**Third in a Series**
**by Roswell Ward**

*Technical Publication Management Consultant*

THERE is a remarkable degree of variation in the status of publication-department managers and in the status of their departments in defense industry. There is also an equally remarkable variation in the qualification of managers.

In the second article in this series (ARMED FORCES MANAGEMENT, April) the question of "inexpert supervision by top management" was discussed. As a natural sequel to the discussion of the ability of top management to completely deal with publication problems, we should examine the qualifications for a publication-department manager. This naturally leads to a definition of the second type of "danger area" frequently encountered in the study of publication-management problems in industry.

## Problem Area No. 2

The second problem is twofold—that of the incompetent publication-department manager, or the manager whose selection over-emphasized one phase of publication work.

In examining the problem it is useful to look at the "chamber of horrors" represented by examples of publication managers who were not qualified for the job. Some of these men did not objectively understand their lack of qualifications. Some of them were trying to "bluff it out." Some did not want to be publication managers at all but had reluctantly accepted the assignment under pressure from top management. In a good many cases the underlying problem was lack of clearly defined standards for publication managers, as well as a lack of dissemination of pertinent information within industry.

As a generalization one of the most frequent difficulties of "the problem publication manager" is his lack of ability to get along with the rest of the organization, either in establishing necessary relationships to obtain important technical information, or in generally interpreting the functions and possible services which can be rendered by the publication department.

Another difficulty with some publication managers is the use of cumbersome administrative methods. This is due to lack of experience in developing adequate procedures for the operation of a publication department, and, also, to lack of published information on successful office systems and procedures as used in industrial publication departments.

## A Good Manager?

It is obvious that a publication manager should have positive characteristics to replace all the negative characteristics defined in the above summary.

The following are recommended prerequisites for a qualified publication manager. He should have:

1. Sufficient technical knowledge to understand basic principles and application of company products. He should be able to work intelligently with engineers and research and development personnel, without necessarily going into specialized design or operating detail. His technical background could be based on education, work experience and significant avocational experience or a constructive combination of all three.

2. Experience in factual writing and editing of technical or semitechnical material. Other similar experience, executive ghost writing, popular writing, etc., will be a definite asset.

3. Experience in working with graphic arts production specialists; technical photographers and illustrators, renderers and retouchers; typographers; layout artists; offset and letter-press printers; book binders, etc. He should have knowledge sufficient to evaluate and select personnel and/or outside vendors in these fields and be able to make competent judgments on costs and quotations.

4. Experience in evaluation and selection on subcontract negotiations with technical writing services.

5. Proven administrative ability in selecting, training and supervising writers, editors, and graphic arts personnel; advising management on publication operations; organizing, planning and scheduling publication work involving cost studies and budget preparation; ability to interpret publication programs internally and externally and develop harmonious relations with all cooperating departments, divisions and outside organizations.

It is quite evident that it is not pos-

*Copyright 1958 by Roswell Ward

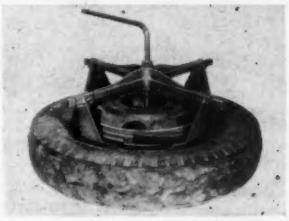
SUBJECT:
Simplified Bead-Breaking without damage, and inflating without danger of exploding lock rings!

Even pressure of Break-Safe breaks beads easily (Regardless of rust build-up or sticking.)

BREAK SAFE
Pat. Pending

Lightweight, Portable, TRUCK
TIRE TOOL
*Eliminates Pry Bars, Sledge Hammers, Bird Cages*

IDEAL FOR BEAD BREAKING AND DEMOUNTING ALUMINUM WHEELS . . . WITHOUT DAMAGE!



Lock rings easily removed (Even by hand).

100% Controlled Safety when inflating

Complete information from:

PAR SALES CO.,
1647 N. Gower St., Hollywood 28, Calif.

For more facts request No. 3 on reply card.

sible to approach the qualification of a publication manager entirely from the writing or editorial side, or the technical or scientific side, or the administrative side. Actually, as defined above, a publication manager should have a practical combination of skills, education and experience in the above three fields. He should be a good personnel man, good employee counsellor for graphic arts personnel, a good teacher.

If the organization is developing or considering developing a publication department or a technical information presentation department to unify most of the organization preparation of product and production information, the publication manager should also have some knowledge of industrial publication relations, and be able to work with specialists in films, exhibits and industrial advertising, as well as other specialists who may be called upon to present company information. It does not follow that a good technical writer can develop into a good technical editor or necessarily "graduate" into a good publication manager.

It is therefore recommended that publication managers be evaluated not only in direct connection with publication skills but also with regard to general supervisory, planning, organizing, negotiating and human-relations skills.

Some manufacturers, who have been notably successful in their publication work, have deliberately set out to develop publication managers with these well-balanced qualifications.

In other organizations there are publication managers who would like to develop along the lines suggested, but they are not permitted to by top management. In still other organizations neither the publication manager nor top management are fully aware of what should be done. It is hoped that further study of this problem by representative manufacturing organizations, management engineers and by educational and professional groups interested in the subject will bring about an understanding of what the publication manager as an executive with broad range of publication skills and administrative ability can efficiently and effectively contribute to their organizations. It is hoped that top managements will realize that this is the sound approach, rather than giving an engineer the sudden title of "supervisor of publications."

Since the publication manager is really the key person in the development of better organized work in defense industry, this whole problem of development of good managerial talent is a real challenge to both industry and the Armed Forces.



"Backward or Forward in Filing"

"HQ, MATS, Washington, D.C. — A revolutionary new system for filing officer personnel records at this headquarters . . . called Rotor-Corres-Files . . . allows file clerks to handle twice the previous number of officer records . . . with greater speed and efficiency . . . represents a saving in both time and manpower . . ."

*This book contains in charts and illustrations answers to the following questions:*

**VALUABLE BOOKLET FREE**

There is no obligation to us, but we feel you have an obligation to your organization, so that no one can say, a year from now, "If we had only known all of the facts."

1. The Space Problem—The True Answer.
2. How to eliminate Traffic and Congestion.
3. Filing Clerk Morale—The WHY facts.
4. Motion Study of Filing Operations.
5. Time Saved thru Operation Elimination.
6. Comparison of three filing methods by square feet and lineal
7. Results of a prospect's survey of five prominent users on a point basis.

Creator of Effective Tools for Effective Management

Phone Westport, Conn. CA 7-4111 or write

WASSELL ORGANIZATION, INC.

Westport, Conn.

IN USE IN ALL BRANCHES OF GOVERNMENT
WRITE FOR NEW BOOKLET "BACKWARD OR FORWARD IN FILING"
or
Consult our GSA Federal Supply Service Contract Class 54—Part III—Sec. B—Cont. No. GS-00S-15367 GSA Distribution Code 7E & 79 Item No. 54-F-2325

For more facts request No. 11 on reply card.


## Dates to Circle

**May 8-9**

American Ordnance Association 40th annual meeting—Jacksonville, Fla.; hosted by U.S. Navy.

**May 15-16**

Operations Research Society of America Annual Meeting—Boston, Mass.

**May 15-16**

Armed Forces Management Assoc., Fourth Annual Conference—Pentagon, Washington, D.C.

**May 16**

Armed Forces Day Dinner—Sherton-Park Hotel, Washington, D.C.; sponsored by the Navy League, Air Force Association, and Military Order of the World Wars.

**May 18-24**

Seventh semiannual Institute for Officers of the Army Medical Specialist Corps—Walter Reed Army Institute of Research; sponsored by the Institute.

**May 26-28**

National Office Management Association Conference—Conrad Hilton Hotel, Chicago; sponsored by NOMA.

**June 4-6**

Armed Forces Communications and Electronics Assn., Convention—Washington, D.C.

**June 9-10**

Canadian Computer Conference—Toronto, Canada.

**June 9-13**

International Automation Exposition and Congress—Coliseum, New York, N.Y.

**June 11-13**

Association for Computing Machinery Annual Meeting—Urbana, Ill.

**June 12-14**

Ninth Annual National Conference and Convention of the American Institute of Industrial Engineers—Hotel Statler, Los Angeles.

**June 14 to July 3**

Three-week training program for middle managers—Lake Arrowhead Conference Center; sponsored by University of California Graduate School of Business Administration.

**June 16-18**

Second National Convention on Military Electronics—Washington, D.C.

**June 17-20**

Annual Cornell University Industrial Engineering Seminar—Cornell University, Ithaca, New York.

## WALL STREET MOVES TO MAIN STREET

by W. Mac Stewart*

Occasionally you hear the remark, "Me, invest in stocks? I'm no millionaire!" There are still some people who have the idea that investments are only for the wealthy. And that was once true. But what has happened?

For the past 150 years common stocks have played a major role in the industrial development of our Nation. For most of those years, ownership of common stocks was pretty much in the hands of a relatively few of the Nation's wealthy families.

During the past 25 years, however, the picture has changed completely. During this time, the majority of industry ownership has shifted into the hands of the average man—people like you and me. Two-thirds of the stockholders of America are in families earning *less than $7,500 a year!* This phenomenon of expanding ownership of American industry by millions of average citizens was discussed on this page in the January, 1957, issue, in considerable detail.

Even more recently it is evident that common stocks are becoming an integral part of family financial planning. In most cases, this is a result of direct action on the part of the wage-earner himself, through outright purchase of common stocks or mutual-fund shares. For example, there are now about 10 million shareholders in our Nation, 3 million of whom own mutual-fund shares. Compare this with the 6½ million shareholders as recently as 6 years ago.

But in addition to direct ownership, common stocks are playing a major part in the future of other millions of families through profit-sharing plans and pension plans. More and more the trustees of these pension funds are turning to common stocks, some investing direct, others through mutual funds. So while Mr. X may not, himself, be investing in common stocks, he will some day enjoy the benefit of such long-term investment when he receives his termination or retirement benefits.

A strong indication of the future direction of investments is provided by insurance companies—long the stronghold of the fixed-dollar-return investment. Borrowing a page from the mutual-fund book, several companies are now talking about "variable annuities." This is an insurance plan in which a portion of the premium is invested in securities. The policyholder will then receive a "variable" return, rather than a fixed, guaranteed amount. These companies have come to realize that participation in the growth and income of common stocks is necessary in order to provide their policyholders a reasonable return on their money when annuity policies mature.

These major trends—increased individual ownership of common stocks, evergrowing investment in common stocks by pension plans and efforts by insurance companies to establish so-called "variable annuities"—have been brought about primarily by three economic factors:

*First* is the realization by both individuals and companies that the fixed-return-type of investments do not fill all the needs of the average wage-earner. They are adequate for protection against an untimely death of the family breadwinner, but they lack the purchasing power needed if he should live to retire, when he must depend solely on retirement benefits or liquidated insurance policies.

*Second* is the effect of long-term inflation, as demonstrated by the plight of many retired people today. Those who are retired on a dollar amount of income that was determined years ago are in bad financial straits now. Measured by even 1948 standards, today's dollar has purchasing power of only 81.6¢. If the purchasing power of that dollar continues to decline for the next 10 years as it has the last 10, you can imagine the squeeze they will be in. Suppose that in 1948 you had set up a 20-year retirement program that would give you a guaranteed $300 a month starting in 1968. At that time, $300 was adequate to live on. But if the present rate of inflation continues, when you retire, that $300 will have the purchasing power that $138 had in 1948. How well will you live on that? This erosion of the purchasing power of the dollar is one of the most potent reasons why the retirement plans of the average person should include participation in common-stock ownership. The yield and growth of a carefully selected, diversified group of stocks tends to rise in general relation to the cost of living.

*A third reason* why common stocks are becoming increasingly popular among fund trustees and insurance companies is the growing strength and solidarity of America's industry and the companies that constitute our industrial might. Many of these institutional investors formerly favored bonds of these companies—and bonds do have an appropriate place in some of these trusts. But through the years they have watched the fixed income and little-or-no growth of those bonds being left far behind by the common stocks of

*Vice-President, Research, Hamilton Management Corporation*

Interested in a
**COMMON STOCK INVESTMENT PLAN?**

You can share in the ownership of over 80 major corporations in 20 basic industries, by lump sum investment or by monthly investments of $10 or more. Objectives are both current income and future growth.

Hamilton Funds
Dept. E1 Box 4210, Denver 9, Colo.
Please send prospectus-booklet without obligation.
Name
Address
City State
For more facts request No. 12 on reply card.

Keystone Custodian Funds
Keystone Growth Fund
Series K-2
A diversified investment in securities selected for possible long-term growth of capital and future income.
The Keystone Company
50 Congress Street, Boston 9, Mass.
Please send me prospectus describing your Growth Fund, Series K-2.
Name
Address
City State
P-58
For more facts request No. 13 on reply card.

the same companies. And where prudent investors once placed all common stocks in the category of speculative investments, that feeling has undergone some sharp revisions. Years of experience in all types of economic climates—war and peace, recession and boom—have given them confidence in the common stock on which American industry is built. Whether they realize it or not, perhaps 50% or more of all civilians will share in the benefits of common stock investment by the time they retire—through profit sharing or pension plans, union welfare funds or their own investments. Even now, more than one adult out of each 12 is a stockholder, and their ranks are growing at the rate of a half-million persons a year. These are not "the wealthy," but are average family men, with average incomes, who have the foresight to build for the future. This broad base of ownership of the production might of America is one of our most potent weapons against foreign ideologies.


**AN FITTINGS & HARDWARE**

***Stainless, Aluminum, Brass, Steel***

All sizes-immediate delivery from world's largest shelf stock. Buy direct from manufacturer. Lower prices—quicker service. Send for free wall charts showing complete line of AN & MS fittings and hardware. We also machine parts to your own special print.

**COLLINS ENGINEERING CORPORATION**
9050 Washington Blvd., Culver City, California


## Run Down of Key Contracts

### Army

$15 million plus to **Douglas Aircraft Co.** for Nike-Hercules missile launching items and Nike repair parts.

$7.4 million to **California Institute of Technology** for engineering research and development relating to missiles, free rockets and wind-tunnel operation.

$10.8 million to **Burroughs Corp.** for electronic equipment and maintenance spare-parts kits.

$4.5 million to **Sylvania Electric Products, Inc.** for work on project PLATO.

$1.7 million to **Cornell Aeronautical Laboratory** for R&D work on Lacrosse missile.

$25 million to **Chrysler Corporation** for further work on the Jupiter missile, including repair parts and component parts for training.

### Navy

$25 million to **Philco Corp.** and **General Electric Co.** for production of Navy and Air Force Sidewinder air-to-air guided missiles.

$63 million to **Sperry Gyroscope Co.**, total of three contracts, for production of major components of Talos and Terrier guided missile systems, including computers.

$1 million to **Sylvania Electric Products, Inc.**, to manufacture subminiature electron tubes.

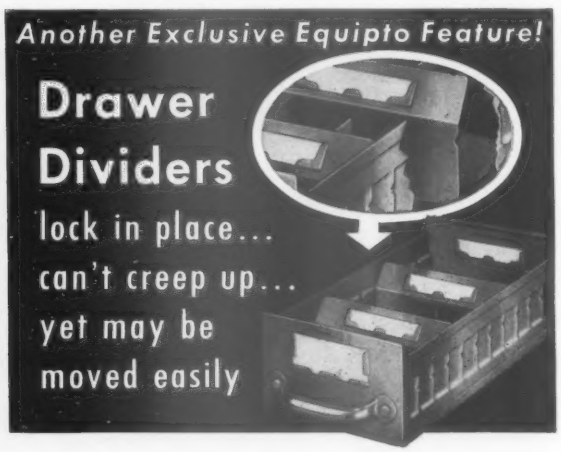
### Air Force

$1.5 million to **Aerojet-General** for solid-propellant rocket development.

$1 million plus to **Acoustica Associates, Inc.**, for development and testing of fuel management systems for the Atlas ICBM.

$23 million additional to **Sylvania Electric Products, Inc.**, for expanded production of the electronic countermeasures system for AF B-58 Hustler supersonic bomber.

$58.1 million to **McDonnell Aircraft Corp.** for F-101B aircraft and related equipment.


**Equipto drawers are of one piece construction — front, bottom, back, with all welded sides. Embossed runners on bottom allow drawer to slide easily. Adjustable dividers lock in place — an exclusive feature found only in Equipto Drawer Units. Tops of dividers are slanted back and have new type instantly visible label holders . . .**

**Equipto Drawer Units are available in all sizes and combinations to suit your individual storage needs. Interested? Why not find out more by writing for complete Drawer manual No. 206.**

**Equipto**

614 Prairie Avenue
Aurora, Illinois

**Manufacturer of World's Finest**
**Steel Shelving • Parts Bins • Drawer Units • Lockers • Carts • Work Benches.**

**For more facts request No. 4 on reply card.**


## Advertisers' Index

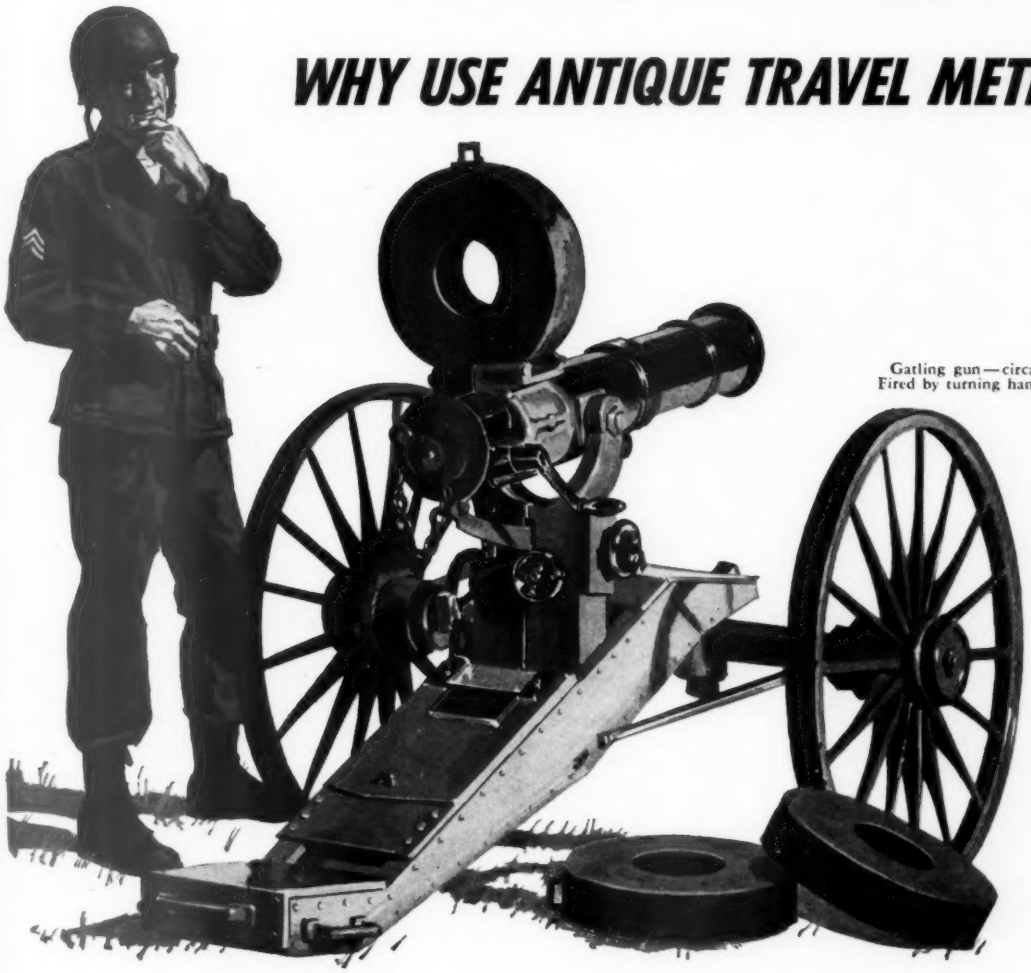

Aerojet-General Corp. ..... Cover 4
Air Transport Association ..... Cover 3
Borg Equipment, Div. of The George W. Borg Corp. ..... 26, 27
Brown, Madeira & Co. ..... 20
Caterpillar Tractor Co. ..... 2
Continental Motors Corp. ..... Cover 2
Equipto Div., Aurora Equipment Co. ..... 48
Graphics Systems Inc. ..... 39
Hamilton Management Corp., The ..... 39, 47
Keystone Co. of Boston ..... 47
Lockheed Aircraft Corp. ..... 13
Par Sales Co., Inc. ..... 45
Radio Corporation of America ..... 1
Wassell Organization, Inc. ..... 11, 37, 40, 46

**Classified**

Collins Engineering Corp. ..... 48

# You wouldn't use this Gatling Gun today—

# WHY USE ANTIQUE TRAVEL METHODS?



Gatling gun—circa 1898
Fired by turning hand crank

# FLY YOUR MEN—SAVE TIME AND MONEY!

Slow surface travel can be extremely costly in terms of per diem allowances and pay dollars. In many cases, the actual cost of the ticket is even more than for a Scheduled flight. Your highly trained specialists and other essential manpower will reach their vital posts *five times faster*—and often dollars cheaper—by flying the Scheduled Airlines.

**COMPARE THESE RAIL-AIR COSTS!**
A train trip from Baltimore to Seattle costs the government $150.31, including Pullman and meals. Travel time: 63 hrs. 30 mins. The same trip by SCHEDULED AIRLINES costs just $140.70, including meals. Travel time: 7 hrs. 55 mins.

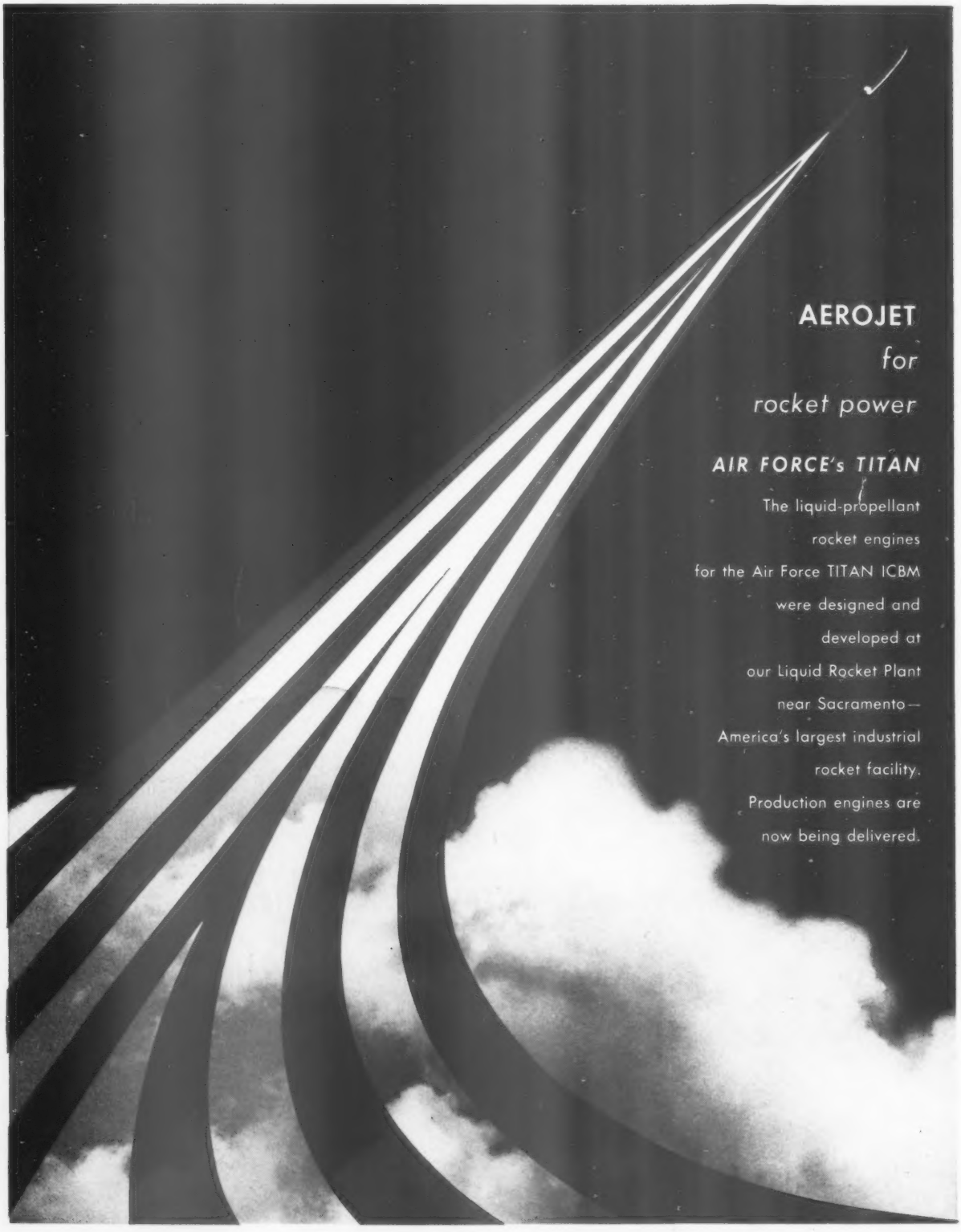
**SAVINGS BY AIR:**
**MONEY—$9.61 TIME: 55 hrs. 35 mins.**

*10% Discount for Official Travel on TR's*

THE CERTIFICATED **Scheduled Airlines** OF THE U. S. A.

ALASKA AIRLINES
ALLEGHENY AIRLINES
AMERICAN AIRLINES
BONANZA AIR LINES
BRANIFF AIRWAYS
CAPITAL AIRLINES
CENTRAL AIRLINES
CONTINENTAL AIR LINES
DELTA AIR LINES
EASTERN AIR LINES
FRONTIER AIRLINES
LAKE CENTRAL AIRLINES
LOS ANGELES AIRWAYS
MOHAWK AIRLINES
NATIONAL AIRLINES
NEW YORK AIRWAYS
NORTH CENTRAL AIRLINES
NORTHEAST AIRLINES
NORTHWEST ORIENT AIRLINES
OZARK AIR LINES
PIEDMONT AIRLINES
SOUTHERN AIRWAYS
SOUTHWEST AIRWAYS
TRANS-TEXAS AIRWAYS
TRANS WORLD AIRLINES
UNITED AIR LINES
WEST COAST AIRLINES
WESTERN AIR LINES

DEPENDABLE, SCHEDULED SERVICE SAVES MILLIONS OF VALUABLE MAN HOURS FOR THE MILITARY




AEROJET-GENERAL CORP.

THE GENERAL TIRE

A SUBSIDIARY OF THE GENERAL TIRE & RUBBER COMPANY